THE PUBLIC AND PRIVATE OWNERSHIP OF INDUSTRIAL ENTERPRISE

A Study of Municipal and Company Enterprises in the Gas and Electricity Supply Industries

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A thesis submitted

by

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The existing literature relating to the subject matter of this study can be divided into three main groups. Firstly, there is the work dealing with municipal trading, of which the most comprehensive and best known are books, both called "Municipal Trading", by Prof. Knoop and by Dr. H. Finer. The most recent, Dr. Finer's work, was published in 1941, and deals with the 'big four' of municipal trading - gas, water, electricity, and transport. It describes in detail the history of the development of municipal trading in these four industries, and the pattern of municipal administration and financial procedure, discussing in particular the problems of central control over municipal trading activities, the use of surpluses, and the problems of areas and of pricing. The difficulties of comparisons between company and municipal undertakings are discussed, but no such comparisons are attempted.

Secondly, there are general works on the structure and economic problems of the gas and electricity undertakings. These include Ballin's "Organisation of Electricity Supply in Great Britain", and Mr. Philip Chantler's book "The British Gas Industry." These both deal with the problems of the industry as a whole, with some reference to the pattern of ownership. There are also a number of more

technical works on the two industries. Dr. Ballin's book describes the growth of the municipal and company ownership of electricity undertakings, and deals at considerable length with the efforts to overcome the defects of the existing ownership pattern which resulted in the formation, first of the Electricity Commission and then of the Central Electricity Board. Mr. Chantler's book deals, inter alia, with the early history of the gas industry, the techniques of manufacture, the nature of the market, the uses of by-products, the special problems of using supplies of coke-oven gas, the nature of the public utility concept, the make-up of costs and pricing problems. The P.E.P. Organisation published general surveys dealing with both of these industries, before the war (1936).

Apart from these, there are a number of books dealing indirectly with some aspects of the gas and electricity industries or with municipal trading enterprise. These include general works on local government, such as Finer's "English Local Government", and Robson's "Century of Municipal Progress", and those dealing with special aspects of it, such as Dr. Lipman's work on Local Government Areas. Some aspects of the electricity industry are dealt with in works concerned with the growth of Public Corporations in

Britain, such as Gordon's "The Public Corporation in Great Britain", and O'Brien's "British Experiments in Public Ownership and Control." More recently some works have been published dealing with the problems of nationalised industry in the post-war period. These include Chester and Clegg's "The Future of Nationalised Industry" dealing mainly with the administration of each of the newly nationalised industries, and Little's "Price of Fuel" which discusses the theory and practice of pricing in the gas, electricity and coal industries.

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INTRODUCTION

The basis of this study is to attempt to throw light on some of the problems arising from the public ownership of industrial enterprise through making a comparative examination of the records of public and private ownership in the gas and electricity industries before nationalisation. The peculiar advantage of studying gas and electricity supply is that only here (and to a lesser extent with the other municipal 'trading' services of water and transport) can the two forms of ownership be seen existing side by side, operating in similar circumstances in the same industries and over the same period of time. There is no other sector of British industry in which comparable conditions have existed.

There is of course one obvious disadvantage in basing a comparative study of public ownership on the pre-nationalised gas and electricity industries. Today in Britain 'public ownership' almost invariably means ownership by some form of Public Corporation. That being so there are clearly many questions to which no answer can be found in a study of municipal enterprise. But there are some underlying problems which relate to all forms of public ownership to which the record of municipal enterprise is relevant. Indeed it

is possible to go so far as to claim that exclusive concentration on the organisation of the Public Corporation may have diverted attention from some of the more general issues connected with public ownership.

The plan of the study is to examine first of all the phenomenon of municipal 'trading' enterprise, studying its development, and considering it in relation to other municipal services. Then the general structure of the gas and electricity industries is described. After this the main comparisons are attempted, under the headings of efficiency; financial policy; location policy; and administration. (In studying the difficult problem of the relative levels of efficiency achieved under public and private ownership in these two industries some attention is given to the meaning of the word efficiency itself and to evaluating the significance of the different methods of making efficiency measurements).

The chief specific questions to which answers are sought here are as follows:-

1. Why did the public ownership of industrial enterprise develop in the nineteenth century?

2. In what essential ways did the nature of the 'trading' services of local authorities differ from those of their other activities? (This question links up in some ways with that

on purpose).

3. How far can the relative levels of efficiency achieved by the two forms of ownership be compared?

4. What was the significance of any differences in the financial policies and practices of municipal and company gas and electricity undertakings?

5. Did the type of ownership affect location policy in any way?

6. What differences in the pattern of administration existed between company and municipal undertakings?

7. Was there any basic difference of outlook and purpose inherent in the two alternative types of ownership?

8. How far can any conclusions resulting from the study be applied to the possible future developments of municipal and state 'trading' enterprise?

NOTES ON TABLES AND FOOTNOTES.

All tables refer to England and Wales except where a statement to the contrary is included in the heading.

Abbreviations:

C.B. = County Borough.

M.B. = Municipal (Non-County) Borough.

U.D.C. = Urban District Council.

R.D.C. = Rural District Council.

L.A. or l.a. = local authority.

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E.C. - Gen.Elec. = Electricity Commissioners - Generation of Electricity in Great Britain.

SYNOPSIS

The main theme of this study is an examination of some of the problems of public enterprise as revealed in the gas and electricity industries under company and municipal ownership.

The first topic is the development of the pattern of public and private ownership in the gas and electricity industries in the nineteenth century. The different reasons for allowing local authorities to supply public utility services are examined. Then the particular position of municipal 'trading' services, and the difference between these and 'social' services is discussed.

In the next section the general structure and problems of the gas and electricity industries, as they existed at the end of the period of company and municipal ownership, are investigated.

In the central part of the thesis the results of the two forms of ownership are compared. Before attempting to compare the efficiency levels of municipal and company undertakings, some attention is given to the general problem of efficiency measurement. Besides efficiency the other main bases of comparison are those of financial practice, location policy, and methods of administration.

Finally, the results of these comparisons and their relevance to the more general issues of public ownership are discussed.

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SECTION I

THE DEVELOPMENT AND NATURE OF MUNICIPAL 'TRADING' ENTERPRISE

CHAPTER I

Reasons for the development of municipal 'trading' enterprise in the nineteenth century

The purpose of this chapter is to discuss the reasons for the growth of municipal trading enterprise in the nineteenth century and to describe the development of public control and ownership in the gas and electricity industries up to 1900.

Why were local authorities allowed, during a period in British history when the influence of laissez-faire theory on the relationship between government and industry was very strong, to operate undertakings which could be also run by private enterprise? Why did successive governments impose some controls and restrictions even on those parts of the gas, water and electricity industries which were owned by companies? There are a number of answers to these questions though they might be summed up by saying that because of the peculiar nature of the industries concerned unrestricted private enterprise proved to be extremely unsatisfactory.

The first, and easily the most important, reason for

the development of public ownership (and of public regulation of company undertakings) in the gas, water, and later, electricity industries was the strong 'natural' tendency towards monopoly. It is almost impossible to maintain competition in services like gas and water supply which involve the laying of pipes to the house or factory of each consumer. It is obviously extremely wasteful to have two or more sets of gas mains in the same street, but this is the only way of ensuring direct competition between rival gas companies in the same district. It would be equally expensive and wasteful for the individual consumer to purchase his supply of gas or water now from one company and now from another, with all the resulting trouble of connecting his premises to the different systems of supply. Apart from this consideration, a gas or water works must be of a certain size if it is to be at all efficient. Most towns could not support more than one gas or water works of optimum size. The almost inevitable result of unregulated development would be the establishment of a local monopoly. Nevertheless, it was not without a struggle that the effort to maintain competition in Gas and Water was abandoned. The Parliament of the 1830's and 1840's had an almost religious belief in the beneficial effects of competition. Just as, for a time, it was hoped to encourage competition between

railway companies[1] so an attempt was made to grant powers to rival Gas and Water companies. The areas of supply of water companies in London, for instance, were deliberately left vague by Parliament, in order to encourage "healthy competition". But the experiment was predestined to failure. Experience soon showed that competition meant an inefficient and expensive supply of gas or water, and that a period of fierce competition between rival companies was almost invariably followed by combination and consequent monopoly. In London, in particular, the results of competition between water companies proved little short of chaotic. The Engineer of the Trent Water Works, which supplied Nottingham, (T. Hawksley), reporting to the Commission on the State of Large Towns of 1844-5, spoke of the wastage in London through divided control - contrasting this with the unified system with which he was concerned.[2] J. Quick, Engineer of the Southwark and Vauxhall Water Co., described how two companies, the St. Johns Co., and the Vauxhall Co., laid duplicate pipes in the same area in 1841. The water rate was lowered temporarily, then

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1. L. Knowles, Industrial and Commercial Revolutions in Gt. Britain during the nineteenth century, p.265 et seq.

2. Commission on the State of Large Towns and Populous Districts, 1844-5, 2nd Report, p.44.

raised again, when the rival companies made an agreement in 1842.[1] With the multiplication of gas and water companies' laying mains, together with public sewers, the ground under London's streets became a maze of pipes and conduits. W. Mylne, Civil Engineer to the New River Company informed the Commissioners that beneath one part of Upper St. Martin's Lane were to be found the following: one main belonging to the Chartered Gas Co., two belonging to the London Gas Co., three to the New River Water Co., two to the Equitable Gas Co., and the public sewer. This confusion of supply pipes sometimes had surprising results. Mr. Mylne stated that when water pipes belonging to his company were opened and a light applied, gas in them ignited "as if the pipe were a gas-pipe".[2] The results of Parliament's desire to encourage competition led to other undesirable consequences. "It was no novel thing for two or three companies to be in the same street touting for customers just in about the same way as the milkman does today. This naturally meant that the streets were constantly being dug up, and the navvies themselves would engage in battles royal with their pickaxes and shovels from opposing entrenchments."[3]

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1. Commission on the State of Large Towns and Populous Districts, 1844-5. 2nd Report, p.44.
2. Ibid.
3. G.F. Stringer "The Romance of London's Water Supply", The Morning Post, 9th December, 1935.

The Commission came to the conclusion that competition between water companies was "disastrous". It was soon realised that to allow the gas or water supply to continue in the hands of an unregulated private monopoly was equally unsatisfactory, entailing high prices, a restricted and often inefficient service, and the constant danger of the exploitation of the consumer. The State of Large Towns Commission discovered one company paying a dividend of 30%. The Liverpool and Harrington Water Co. made a charge of one shilling in the pound of the rental of premises supplied, and for this payment water was available only on alternate days. It was calculated that Liverpool Corporation could supply water at one sixth of the price charged by the Company.

A local builder complained of the shortage of water in Liverpool for combating fires. If it did not offer a satisfactory supply of water the Liverpool Company seems to have been able to use its monopoly position to make a comfortable profit. At the time of the Commission's Report its £100 shares were valued at £610.[1] In London also competition usually gave way to monopoly. John Liddle, the Medical Officer of the Whitechapel Union, told the Commission in evidence that the New River Co.,

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1. (Evidence of Samuel Holme.) State of Larg Towns, etc., Commission. 1st Report, p.278.

would charge £63 for supplying 100 houses. (The New River Co., was founded by Sir Hugh Myddleton in 1606 to bring water by means of the "new river" which was cut from Hertfordshire to London, and became the most important London water undertaking, eventually buying the undertaking founded by Merrys.) He added that: "There cannot be a doubt that the poor pay most exorbitantly for water; the water companies, being monopolists, charge the landlords extravagantly high."[1]

The results were deplorable. In 1850 there were approximately 80,000 houses in London, with a total of 640,000 inhabitants, which had no piped water supply.[2] The threat of cholera epidemics was always present. A London surgeon, J. Toynbee, spoke to the Commissioners of poor children, living on the upper floors of tenements, who were kept dirty because their mothers were not able to carry water upstairs to wash them. Dirty water was often used several times for washing both clothes and people.[3]

The Commissioners found that the supply of water was,

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1. State of Large Towns, etc., Commission. 1st Report, p.107.

2. Jephson, Sanitary Evolution of London, p.21, quoted Knowles, op.cit., p.80.

3. State of Large Towns Commission, 1st Report.

almost everywhere, highly unsatisfactory. They wrote of "... the almost universal scarcity of supplies of water for domestic use."[1]

There were two ways in which Parliament might deal with the situation. One was by regulating the affairs of the private monopolies already established in the gas and water industries, fixing maximum profits or prices and laying down conditions about the supply of the service concerned. The alternative was to create a new or rival source of supply managed by some public body, the local authorities being the most obvious candidates. In fact, both policies were followed to some extent. The common American solution - the granting of monopoly powers for a considerable period to private firms or persons, was not adopted, largely because of the adverse experience of the working of private gas and water monopolies.

The second reason for the development of municipal 'trading' enterprise, and of public control which applied particularly to the water industry, and in a less degree to gas supply was the special 'social necessity' of the services concerned. The particular importance of a satisfactory supply of pure water has already been illustrated in describing the results of unregulated

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1. 2nd Report of Commission, 1845, p.8.

monopoly. It was realised that the adequacy of the supply of water to the public was a matter vitally affecting the health of the nation. The State of Large Towns Commission report even professed the belief that the general shortage of water in the urban centres was a cause, not only of disease, but also of moral degeneration.[1] The profit motive alone had proved to be insufficient to ensure the provision of an adequate water supply to all sections of the community. The supply of water to some working class districts was often difficult to justify commercially - it was not a good business risk. The price which the poorer consumers could afford to pay for their water supply was too low to yield a satisfactory profit. The entrusting of water supply to some body concerned with social welfare as well as, or instead of, with making a profit, was the obvious solution. The State of Large Towns Commission realised that it was often not worth while for water companies to supply water to the poor. The Commission recommended that water supply should be entrusted to "some independent and disinterested body" and that local authorities should contract with companies for providing a water supply, or should themselves perform the functions of a water undertaking.[2]

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1. Commission on State of Large Towns and Populous Districts, 2nd Report, 1845, p.8.

2. Ibid., pp.92-3.

A second influence on the development of the trading activities of local authorities was the provision of public services which could not, because of their nature, be supplied by private enterprise. A leading example of such a service was public lighting - both of streets and public buildings, which could not be supplied in the ordinary way by capitalist enterprise because of the impossibility of apportioning the charge among the individuals who benefitted from the service. The Lighting and Watching Act of 1833 provided for the election of Inspectors in parishes and boroughs who could provide lamps and lay down pipes for public lighting and contract with private undertakings for the supply of gas. From this stage it was only a short step to the actual manufacture of gas by local authorities (when these took over the functions of the Inspectors and other similar ad hoc bodies).[1] The Manchester Improvement Commissioners began the manufacture of gas to light public buildings in 1807, and began to sell gas to the public in 1817. The remaining factors relate specifically to the development of municipal 'trading' activities rather than to the growth of control over company undertakings.

The need for the co-ordination of water and gas

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1. There was a similar development in the early days of electricity supply. See for example Select Committee on Electric Lighting Bill, 1882, Q.23.

supply with other local authority functions provided a fourth argument in favour of the municipal control of these undertakings. The State of Towns Commission Report considered the importance of the co-ordination of water supply with other local authority activities - "We recommend that the necessary arrangements for drainage, paving, cleansing, and an ample supply of water should be placed under one administrative body."[1]

A fifth reason for the nineteenth century growth of municipal trading can, again, be found in the special nature of the services concerned. Gas, water, electricity and tramway undertakings all involved the laying of mains or tracks in public streets. This meant that before they could operate at all they needed to obtain powers from Parliament to break up the streets, and usually, the sanction of the local authority which was the Highways authority in their region. As in the case of railways, some degree of governmental interference was involved at the inception of any service, if only to give the undertaking concerned the powers which it required to interfere with the rights and property of the public or of other persons. An entrepreneur wishing to build a cotton mill or an ironworks could complete his project

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1. Commission on the State of Large Towns and Populous Districts, 2nd Report, 1845, p.11.

without seeking permission or powers from the government or anyone else. It was only after such severe shocks to the public conscience as those occasioned by the Reports of the Children's Employment Commission[1] that Parliament could be persuaded to interfere in the affairs of the Coal Mining or Textile Industries. But with the gas and water industries, as with railways, some governmental authorisation was usually necessary to enable entrepreneurs to begin operations at all. It was never possible for the most rigid teaching of laissez-faire philosophy to be applied to these industries. A tradition of governmental authorisation and regulation developed, through the necessity of approving Private Bills sanctioning the setting-up of gas and water undertakings. This made the introduction of public control, through local authorities, seem much less revolutionary than it would have done in any of the other industries of nineteenth century England.

Speaking before the Select Committee on the proposed Electricity Bill of 1882 the President of the Board of Trade argued that the Bill would not prevent anyone

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1. First Report, May 1842, dealing with mining, Second Report, 1843, dealing with miscellaneous industries, including nail making, potteries, calico printing.

manufacturing or supplying electricity so long as no public roads were broken up or there was no interference with private property.[1] Where either of these things were done (and without doing them a public supply of water, or gas or electricity, would be practically impossible) the government felt justified in interfering. The undesirability of allowing private persons or companies to break up the public streets was one of the motives which made the local authorities themselves anxious to manage the public utility industries in their own area. The desire to retain complete control of the streets was given by the Town Clerk of Manchester as a reason for the application of his city for powers to supply electricity,[2] in evidence before the 1882 Select Committee.

A sixth and final reason for the growth of municipal trading was the desire of councillors to make a profit on their undertakings which could be used in relief of rates. It is not easy to estimate the influence of this factor on councillors voting to take over or set up a trading undertaking. Although the incentive of a profit

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1. Select Committee on Electric Lighting Bill, 1882. Minutes of Evidence, Q.27. Witness - Thomas Farrer.

2. Ibid., Q.360. Witness - Sir Joseph Heron.

for the rates might influence a council's decision to run a trading enterprise it would not be very likely to be used as an argument in debate. Of the two earliest fields of municipal trading, gas and water, the profit motive applies much more strongly in the case of gas as the profits of a water undertaking were likely to be small and uncertain.

The nineteenth century development of municipal trading does not seem to have taken place as an application of Socialist theory. It was, rather, in the normal tradition of British administration and legislation, a practical attempt to solve the problems which had arisen concerning the management of the public utility industries. The historian R. Ensor writes of the founders of municipal trading - "They were simply empirical Englishmen facing public needs, and trying to meet each of them specifically in what appeared the most practical way."[1] It was not until the late 1880's that the writers of the Fabian Society gave their blessing to municipal trading as municipal socialism.[2] Once the supporters of Fabian Socialism had pointed out that the municipal control of trading undertakings might be the thin edge of the wedge

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1. R. Ensor - England 1870-1914, p.128.

2. E.g. S. Webb, Some Facts and Considerations about Municipal Socialism, 1894.

of Socialism, opposition to municipal trading on political grounds naturally developed. But the members of those Councils which managed trading enterprises were certainly not, generally, supporters of theoretical Socialism. Thus a writer in the Electrical Review of 1900 states, "The advocates of municipalism often were not socialists at all, but for the most part worthy business men."[1] In Manchester, a pioneer of municipal trading, the Council was usually composed almost entirely of businessmen with a firm belief in the blessings of private enterprise.[2]

Some of the reasons mentioned for entrusting the management of the public utility industries to local authorities would have applied equally well to other forms of public control. The tendency until the end of the nineteenth century was to create ad hoc bodies to manage new locally controlled activities. Thus we have the creation of Poor Law Unions in 1834 managed by the Boards of Guardians, and the creation of Schools Boards by the Education Act of 1870. Why were water and gas undertakings not entrusted to special ad hoc bodies but

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1. Electrical Review, 47 (1900), p.712. Cited Ballin The Organisation of Electricity Supply in Great Britain, p.23.

2. Cf. S.O. Simon, A century of City Government, p.358.

added to the other functions of the newly formed "compendions" municipal corporations or to those of the Local Boards of Health which were the ancestors of Urban and Rural District Councils? The answer to this question may be found partly in the mode in which nineteenth century municipal trading developed. Parliament did not impose the management of gas and water undertakings on all local authorities, but left it to the individual council to take the necessary steps to acquire an undertaking. There was no attempt to create an uniform system throughout the country, as in the case of Poor Law Administration. To create new authorities to manage gas and water undertakings would have meant adopting a more active policy, and probably interfering more with the existence of private gas and water companies than Parliamentary opinion would have approved. Another reason which made it possible to rely on existing local authorities to undertake management of water and gas industries was that these services had only developed in the urban areas, and in most of these after 1835, there was a satisfactory system of local government. Poor Law administration, on the other hand, had to cover rural areas as well as the towns, and the 1835 Act had done nothing for rural local government. The parishes,

the only rural local governing bodies, apart from ad hoc boards, existing until 1888, would not normally have been adequate to manage the reformed Poor Law. The advantages of co-ordination, particularly of the water supply, with other local government activities, also seems to have had some influence on the choice of local authority control as the most suitable form of public management. The great disadvantage of municipal control today - the areas problem - was of little consequence in the nineteenth century because the existing state of the technique of the public utility industries did not demand an area of supply greatly different from that of the average local authority.

The methods by which local authorities were given powers to operate 'trading' undertakings, and the growth of public control over gas, water and electricity companies may now be sketched briefly.

It is one of the outstanding features of the English local government system that a local authority can only perform those functions for which it has specific authorisation from Parliament. The continental practice of granting general powers to a local authority has never been followed in Britain. The application of the doctrine of ultra vires has made certain that no local government body can do anything for which the previous

sanction of Parliament has not been obtained.[1] There is not usually a shortage of persons who will be prepared to challenge in the law courts any action of a local authority which appears to exceed its legal powers. Local authorities have therefore had to obtain powers from Parliament for any trading activities which they have desired to undertake.

Parliament has developed various methods of granting fresh powers to local authorities. The early experiments in supplying water and gas in the nineteenth century were generally made under powers granted to individual authorities in private bills. An amusing account of some of the difficulties of private bill legislation is given in a recent history of the Borough of Wolverhampton. In 1852 the Borough Council decided to buy the local water company which was not giving a satisfactory supply. When the company refused to sell preparation was made to obtain powers to set up a separate municipal undertaking. This made the company change its mind, and agree to sell, the Council consequently applying to Parliament for permission to purchase. Meanwhile, however, a second

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1. Attorney-General v. Fulham Corporation (1921 Ch.440), is an example of the application of this doctrine in which the provision of a municipal laundry in which machines were operated by Council employees, was held to be ultra vires.

company undertaking was proposed, and applied to Parliament for a private bill. Considerable expense was incurred by the Council in backing their own bill, and opposing that of the company, before the Parliamentary committee. Expert legal and engineering advice was obtained. The Corporation's bill was rejected, and that of the water company approved. The new water company, amalgamated with the old company which the Council had intended to buy, and the Council was faced with meeting the costs of the rejected bill of more than £8,500, without the powers to levy a rate for the purpose. Bailiffs descended on the Council seizing furniture from the Town Hall, the equipment of the police station and even the fire engine. The matter was eventually settled by the means of a voluntary rate, and the scaling down of the demands of many debtors. In 1868 the Council was allowed to purchase the water undertaking of the amalgamated companies.[1] An enterprising local authority would apply to Parliament for a local Act to acquire or construct, for example, a gas undertaking. As the passing of private bills became more frequent, the need emerged to standardise the provisions made in these bills. To do this, public Acts were passed, containing clauses which were to be

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1. Article by L. du Garde Peach, pp.40-41, The Book of the Century.

included in all private bills passed. A third method adopted by Parliament to confer powers upon local authorities was the passing of public Acts which gave a general authority to certain classes of local authority to engage in specified forms of trading. In so far as these acts related to trading functions they were invariably permissive, laying no compulsory duties on local authorities to engage in trading themselves. From the method of granting powers by public acts developed the use of Provisional and Special Orders. Provisional Orders were often necessary before general powers could be used by a specific authority. The Order is made by the relevant Minister, most usually the Minister of Health, on the application of a local authority. Obtaining a Provisional Order, although cheaper than seeking private bill legislation, can be a lengthy and expensive process. Before granting the Order the Minister must advertise the application and usually hold a local enquiry hearing evidence for and against the proposed extention of powers. When made by the Minister, Provisional Orders have to be approved by the passing of a Confirmation Bill in Parliament. If opposed the Provisional Order is referred to a Parliamentary Select Committee. A more speedy method of obtaining additional powers under the provisions of an existing statute is the Special Order. This only needs

to be approved by resolution of each House of Parliament. In practice the Provisional Order has been used to grant powers to initiate an undertaking while extensions in the size of existing trading undertakings are approved by Special Order.

The first Public Act of the nineteenth century to have any relevance to the growth of municipal trading was the Lighting and Watching Act of 1833.[1] This Act applied to all parishes in England and Wales and was concerned with public lighting. Under its provisions ratepayers could elect Inspectors who could provide armed watchmen, and erect public lamps. The Act is of interest in illustrating the process by which many municipalities became interested in gas supply. One of the earliest and most important functions with which local authorities were concerned was the preservation of public order. One of the best safeguards against robbery and assault in the towns was to have well-lit streets. Municipalities were thus led to provide for street lighting themselves as a precaution against footpads and others of a similar profession. When Murdoch's inventions made gas the most suitable known method of street-lighting, local authorities became directly concerned in obtaining

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1. 3 and 4 Will.4, c.90.

a satisfactory supply for their lamps. The Manchester Improvement Commissioners, pioneers of public gas supply were also in control of the local police.[1] The 1833 Act, however, did not give parishes the power to manufacture gas themselves. They were to contract with a company for the supply of gas, oil, or other lighting material. The 1833 Act, although not concerned directly with trading (the public lamps were to be paid for by a rate levied on houses and land) is also of interest in that it reflects the reluctance of Parliament to interfere with the rights of private property. Gas pipes could not be laid in privately owned land without the owner's consent, and the owner was allowed to alter the position of pipes laid in his ground according to his own inclination. The first legislation to lay down provisions which could be included, simply by reference, in subsequent private bills, was passed in 1847. The "Clauses Act" of this year made the effort in obtaining a private bill a little less laborious and introduced some degree of uniformity into private bill legislation. The Gasworks Clauses Act of 1847[2] contained clauses relating to the construction of gasworks and the right

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1. Cf. p. 9.

2. 10 and 11 Vict. c.15.

to break up streets in which mains were to be laid. The provisions of the Act related to company as well as to local authority undertakings. A check on possible abuses by private monopolies was contained in the clauses fixing a maximum dividend rate (if not specially prescribed in the relevant private bill the maximum was to be 10% on issued capital).

The Waterworks Clauses Act[1] of the same year, aimed at consolidating the provisions usually contained in Waterworks Acts. One of the most important clauses related to the obligation to supply premises situated within the district of the undertaking and within a reasonable distance of mains. This provision, of more importance in regulating the affairs of company than of local authority undertakings, is based on one of the essential conditions for avoiding abuse in the public utility industries - that there shall be no possibility of discriminating against any consumers, but that all prospective consumers shall be entitled to receive the service concerned on the same terms as any other consumer. Discrimination by withholding the supply of a service (an obvious method of blackmail by a ruthless company trying to obtain an exorbitant monopoly price) was an unlikely,

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1. 10 and 11 Vict. c.17.

though not impossible, danger in a municipal undertaking, which was not working primarily to make a profit.

"Clauses" Acts were also passed in 1847 dealing with minor trading, or semi-trading, services. These were the Markets and Fairs Clauses Act,[1] the Harbours, Docks and Piers Clauses Act,[2] and the Cemetries Clauses Act[3,4] all containing similar provisions consolidating the clauses usually contained in the respective private bills. In the case of harbours and markets (as with water) some corporations retained powers in the nineteenth century which they had obtained long before the industrial era. Some of these rights had been obtained by none of the methods described above, but were granted in, or subsequent to, the Corporation's Charter, by the Crown. Thus Chesterfield was given the right to control its market by charter in 1215.[5]

The Public Health Act of 1848 was not without influence on the development of trading undertakings. Following the

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1. 10 and 11 Vict., c.14.
2. 10 and 11 Vict., c.27.
3. 10 and 11 Vict., c.65.
4. Other "Clauses" Acts related to Companies, Lands and Railways (1848) and Commissioners, Towns Improvement and Town Police (1847).
5. Hart and Hart, Introduction to the Law of Local Government and Administration, p.659.

report of the Royal Commission on the State of Towns in 1845, the Act of 1848 aimed at reducing the amount of destitution in the country and removing the constant danger of cholera epidemics by improving living conditions, and consequently the people's health in the towns. In order to do this municipal corporations were given 'public health' powers and Local Boards of Health were formed where no municipal corporation existed. These powers included the regulation of water and gas works, the preservation of public water supplies and the provision of cemetries. The recognition of the importance of a satisfactory water supply in contributing to improved standards of health, and that local authorities had a duty towards their citizens in safeguarding water supplies was a step towards an expansion in the number of municipally owned water undertakings.

The first general powers given to local authorities in relation to housing were contained in the Labouring Classes Lodging Houses Act[1] of 1851. This Act empowered municipal corporations and local health boards to supervise common lodging houses for artisans and also to procure their erection.

The breakdown of competition between gas companies

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1. 14 and 15 Vict., c.34.

in London was recognised by the Metropolis Gas Act[1] of 1860, which sanctioned an agreement between thirteen gas companies in London not to compete in the same district.[2] A further Waterworks Clauses Act was passed in 1863, consolidating new provisions introduced since 1847. The Gas and Waterworks Facilities Act[3] of 1870 introduced the method of obtaining powers by Provisional Order. Under this Act any urban local authority could obtain powers to construct or purchase a gas or water undertaking by applying for a Provisional Order to the Board of Trade. The Act also gave to local authorities a limited power of veto over any proposal to set up a company undertaking in their area. The local authority concerned must give its permission before any Provisional Order could be made to a company, but if it withheld consent its action could be overruled by the President of the Board of Trade.

Further important provisions relating to gas supply were contained in the Gasworks Clauses Act[4] 1871. This

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1. 23 and 24 Vict., c.125.

2. "... said companies, instead of supplying gas by several mains in the same district, have agreed, as far as possible, each one to confine its supply to a separate district, in order to economise capital and avoid the too frequent opening of the public streets."

3. 33 and 34 Vict., c.70.

4. 34 and 35 Vict., c.41.

Act gave extra protection to the consumer of this monopoly controlled service. Under certain conditions, it was made compulsory for all gas undertakings to supply the premises of would-be consumers if these were situated within twenty-five yards of a public gas main. Company undertakings also had to provide a gas supply for public lamps at an agreed price, and to send an annual form of accounts to the local authority in their area of supply. The Act also prescribed minimum standards of quality for the gas supply. This Act was amended in 1875.[1]

The Public Health Act[2] of 1875 made further extensions in the powers of local authorities to engage in trading activities. General powers were given to towns to set up or control a local market. Existing market rights, however, could only be taken over with the consent of the owner. These provisions were extended to rural authorities by the Public Health Act[3] 1908.

The 1908 Public Health Act gave a general sanction to the acquisition of water undertakings. Rural, as well as urban authorities, were empowered to provide a supply of water either by providing a waterworks themselves, or

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1. 36 and 37 Vict., c.89.
2. 38 and 39 Vict., c.55.
3. 8 Edw.7, c.6.

by contracting for a supply with some other person or company. The local authority could not set up its own undertaking if there was an existing authorised water company willing to supply in its area. A municipal water undertaking wishing to build a large new reservoir had to seek authorisation from the Minister of Health, which would be granted only after the holding of a public enquiry. The Act also prescribed methods of charging for a water supply. The two principal methods of charging were by a water rate assessed on the net annual value of the premises, and by measure. In practice very few local authorities adopted the meter system of charging. Another important provision relating to water supply was the power for local authorities to supply to the local authorities of adjoining areas in bulk. The giving of a bulk supply of water needed the approval of the Minister.

The 1875 Public Health Act also contained new provisions relating to the municipal ownership of gas undertakings. These provisions applied to all urban local authorities and to rural districts if these obtained an order from the President of the Local Government Board declaring that the relevant Clauses of the Act should apply to them. The local authorities concerned could now apply for a Provisional Order to give them

powers to form a gas undertaking, if there was no other authorised supplier already established in their district. If there was an established gas company the local authority was given powers to purchase the undertaking, should the gas company agree to sell.

The 1875 Act completed the legal basis, in the nineteenth century, of municipal trading in gas and water. It was now possible for any local authority to purchase or set up a gas or water undertaking without the necessity of obtaining a private bill. In fact private bill legislation was still used by large local authorities, who required special or unusual powers in order to operate an undertaking. Thus the purchase and subsequent expansion of the Birmingham Corporation water undertaking required no less than three private acts within seventeen years, two authorising mainly the raising of capital, the third, in 1892, giving the Corporation powers to purchase the Elan Valley district watershed and construct such works as reservoirs, pumping stations and mains.[1] The first steps of local authorities towards establishing their ownership of transport undertakings were made under the provisions of the Tramways Act[2] of 1870. This Act

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1. The Acts concerned were the Birmingham Corporation Act, 1875; Birmingham Corporation Act 1879, and Birmingham Corporation Water Act, 1892.

2. 33 and 34 Vict., c.78.

did not grant general powers to local authorities directly, but enabled them to obtain them through a Provisional Order made by the Board of Trade. The powers thus attainable were, however, limited to the construction of the tramway track in the roadway. Having constructed a track, the municipality could leave it open to the public to run their own carriages thereon, on payment of a toll (a procedure which must surely have resulted in chaos), or lease it to a company, which would run trams upon it. The second alternative was the one adopted by all the local authorities which built tramways, the most usual period of the leases being twenty-one years. Local authorities were not granted powers to run their own trams on the tracks which they had constructed, the Act stating explicitly "... nothing in this Act contained shall authorise any local authority to place or run carriages upon such tramway, and to demand and take tolls and charges in respect of the use of such carriages." The local authority was given powers to borrow for the purposes mentioned in the Act, but this had to be sanctioned in each case, by the Board of Trade.

The restriction of local authority powers to the provisions of the track for trams did not last for very long. In the same year as the passing of the Tramways Act (1870) Glasgow obtained powers to run its own tramway

service.[1] Various difficulties arose under the leasing system - there were, for example, quarrels between local authorities as lessors and the companies as lessees about the maintenance of the road surface beside the track and about fares. The first English borough to operate its own tramway system, under powers obtained in a private act, was Huddersfield. The Corporation of Huddesfield could find no one willing to lease the track which they had built, and so in 1882 they were empowered to run it themselves.[2] For a time Parliament would only allow local authorities to operate a tramway where they could not find a lessee. Finally, however, all definite restrictions on local authorities wishing to become tramway operators, were dropped. The establishment of the London County Council Tramway undertaking in 1896 marked the final recognition by Parliament of the right of local authorities to engage in this particular form of trading.[3]

At the same time as local authorities were attempting to gain powers to run tramways they were venturing into

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1. Report of the Joint Select Committee on Municipal Trading, 1900-03, Q.100 - Evidence of Sir Courtenay Boyle, Permanent Secretary to the Board of Trade.

2. Joint Select Committee on Municipal Trading 1900-03. Q.102.

3. Ibid., Q.108.

another sphere of trading activities, the last of the traditional "Big Four" of municipal trading - electricity. In the cases of gas and water supply it was only after considerable experience in public control by local authorities under powers obtained in private bills, and after the impossibility of competition between private companies had been proved in practice, that Parliament was prepared to pass general legislation regulating private monopolies and providing powers for local authority control. By the time that the public supply of electricity became technically possible Parliament no longer retained the hope that the unfettered workings of the private enterprise system would establish a satisfactory public utilities industry. In electricity supply legislation preceeded the development of the service.

The first general Act dealing with electricity supply was passed in 1882, when the industry was still largely in the experimental stage. Before the passing of the Electric Lighting Act of 1882[1] the problem of who should control the new industry had been considered by a Select Committee of the House of Commons. This Committee, reporting in 1879, recommended that ample powers should be given to local authorities to supply

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1. 46 Vict., Ch.56.

electricity. The Act itself, as a Bill, had been studied by the Select Committee on the Electric Lighting Bill, which heard evidence from representatives of the Board of Trade, scientists and engineers, and local authorities. The 1882 Act gave general powers to urban local authorities to become electricity undertakers. An undertaking could be set up after the issue of a Licence or Provisional Order by the Board of Trade. These provisions also applied to company undertakings, but companies were placed at a serious disadvantage in comparison with local authorities. Any company undertaking could be purchased compulsorily by the local authority in its area of supply twenty-one years after its establishment. If the local authority did not then use its right of purchase it was given another opportunity to do so every successive seventh year. The price to be paid was the "then" value of the undertaking - that is the market value of the works and plant at the time of purchase.

The 1882 Act was followed six years later by the Electric Lighting Act of 1888.[1] This Act contained both an extension and a contraction of local authorities powers. The twenty-one years compulsory purchase period had proved to be too short to allow the growth of private

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1. 51 and 52 Vict. c.12.

electricity companies. Investors were reluctant to lend to a new experimental industry when the reward for establishing a successful undertaking would probably be compulsory purchase by a local authority after only twenty-one years' operation. The period for compulsory purchase was doubled to become forty-two years.

On the other hand local authorities were given powers to hinder, and probably prevent altogether the inception of a new company electricity undertaking in their area. Provisional Orders granted to companies by the Board of Trade were henceforth to be approved by the local authority in the proposed area of supply. A local authority refusing its approval could be overruled by the Board of Trade. The general legislation of the nineteenth century relating to the electricity industry was concluded in 1899 by a Clauses Act - The Electric Lighting Clauses Act.[1]

A development which was important for the future of municipal trading was a change in the methods of raising capital by local authorities. The important new power which local authorities gained in the 1880's was that of issuing municipal stock and thus borrowing from the public in the same way as a joint stock company. (Municipal

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1. 62 and 63 Vict. c.19.

bonds, paying fixed interest rates and carrying no rights of control over the enterprise must of course, be compared with the Debenture rather than the Ordinary shares of joint stock companies.) In 1880 Liverpool made the first successful issue of municipal stock under powers contained in a Private Act. Following this Birmingham set an important precedent by obtaining powers to issue stock under a Provisional Order. This development has been called "a revolution in municipal finance".[1]

The actual growth of municipal and company gas and electricity undertakings has been fully described elsewhere,[2] and need not be dealt with in detail here. There are a few points about the relative growth of the public and privately owned sectors of these industries which are worth making however.

Firstly, most local authorities were content to allow private enterprise to start the earliest gas undertakings and they did not enter the industry themselves until the pioneer companies had proved that a public gas supply was technically possible and a sound commercial proposition. The four earliest local authority undertakings were Keighley 1824, Beverley 1825, Salford 1831, Stockport

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1. Ensor, England 1870-1914, p.129.

2. See, for example Finer, Municipal Trading, p.41 et seq.

1838.[1] (This excludes Manchester where the public supply started in 1817 was controlled by a quasi-local authority - the Improvement Commissioners.) Compared with the municipal total of four, or, at most, five undertakings formed before 1840 there were at least twelve company undertakings formed before 1820.[2] This tendency to allow private enterprise to undertake the more risky pioneering work applies, though perhaps to a lesser degree, to the other spheres of municipal trading also. Of the country's three largest municipal undertakings, that of Manchester was finally taken over by the Corporation in 1843, Leeds acquired its undertaking in 1870, and Birmingham in 1875.[3]

Secondly the much greater number of municipal undertakings set up in the North and Midlands (and also in Scotland where there were at present only four statutory companies in all) relative to the South is

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1. Finer, Municipal Trading, p.45.

2. Chantler, The British Gas Industry, pp.3-4. The companies were:- in London - 1812 - Gas, Light and Coke Co., 1816 - City of London Co., 1820 - Imperial Co. In the Provinces - 1816 - Exeter, 1818 - Bath, Brighton, Leeds, Liverpool, Nottingham, Oxford, Sheffield, Worcester.

3. Harris, "Municipal Self-government in Britain", from Municipal Year Book, 1938.

notable. The first five municipal undertakings were all in the North - of the first twelve English companies seven were in the South, two in the Midlands, and three (one of which was subsequently purchased by a local authority) in the North. Of the 125 municipal undertakings in England and Wales formed by 1880, 100 were in the Midlands and North.[1] This greater strength of municipal trading in gas in the North remained until nationalisation.[2]

The development of municipal electricity undertakings followed more closely upon the discoveries which made this service possible than did the corresponding growth of municipal gas undertakings. This was partly because Parliament granted the necessary powers to local authorities almost as soon as a public supply of electricity became technically possible, and partly because many local authorities could manage a trading undertaking satisfactorily. It has also been suggested that local authorities were influenced in applying for a Provisional Order to supply electricity by their desire to protect their investments in the gas industry. Nevertheless the Electric Lighting Act of 1882 did not lead to any immediate

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1. From figures given in Finer, "Municipal Trading"
2. Cf. Map. A & C.

large scale development in the electricity supply industry, either by local authorities or by companies. The local authorities still tended to be cautious about entering what seemed a speculative and uncertain industry, while private enterprise was deterred from entering the industry by the terms of the 1882 Act - giving local authorities the right to purchase company undertakings compulsorily after only twenty-one years from their establishment.[1] The development of company, and subsequently of local authority undertakings was more rapid after the Electric Lighting Act of 1888 was passed, extending the period for compulsory purchase to 42 years from the date of formation.[2] The position by the end of the 19th century was that many local authorities had been given powers to supply electricity in their areas, but were backward in making use of these powers. By 1906 366 Provisional Orders had been granted to local authorities in the United Kingdom, but no supply of electricity had been begun by nearly two-thirds of the authorities concerned.[3] The dates of acquisition for the largest English municipal undertakings were:- Manchester 1893; Liverpool 1883; Birmingham 1900.[4]

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1. Cf. p. 31.
2. Cf. p. 33.
3. Electrical Review, 50, 1902, p.35 - Cited Ballin "The Organisation of Electricity Supply in Great Britain".
4. Harris "Municipal Self-government in Britain".

The main motive for the nineteenth century experiments in public ownership and control of the gas and electricity industries was the breakdown of competition (in gas and water supply) and the essential nature of these industries. There was at first no particular objection to public ownership. The supply of gas and electricity by local authorities was thought of as good business practice, and not in any sense as 'municipal socialism'. Indeed it seems that the regulation of company undertakings met with more opposition than the giving of powers to municipalities. It is remarkable that by the time of the passing of the Electricity Act of 1882 local authorities should be preferred to companies as undertakers in the newly developing industry. In the light of the subsequent history of the industry it would seem that the government of the time was in fact a little too optimistic in its estimate of the advantages of municipal ownership.

CHAPTER II

The distinction between 'trading' and 'Social' municipal services

The object of this chapter is to investigate the essential nature of municipal trading activity and to discover to what extent there was any real difference - both in theory and in practice, between 'trading' and 'social' services. In order to answer this question the position of the different services controlled by local authorities is investigated and a distinction sought between 'social' and 'trading' services. It is a matter for speculation rather than for research to know whether most of the councillors responsible for the management of trading undertakings consciously adopted an attitude towards these services differing from that towards the 'social' services. It is probable that the majority of them would have found it difficult to define the precise difference between the underlying assumptions of their work on say, the Education Committee and the Gas Committee. Nevertheless there may have been some fundamental difference either in the essential nature of 'trading' and 'social' services themselves or in some definite objective

distinction between their respective managerial policies. It is the answer to this question which is sought here

There are several criteria which can be, or have been, used, as a basis for the classification of some local authority services as 'trading'. First there is the attempt to find a basic difference in the nature of the two groups of services based on a distinction between 'productive' and 'non-productive' or economic and non-economic activities which derives from the classical concept of the sphere of economics. The reasons for considering that the description 'economic' should be restricted to certain activities only of a local authority do not seem very adequate. If the subject matter of economics is taken to be the problem of scarcity, or, to use Professor Robbin's more precise definition - "the science which studies human behaviour as a relationship between ends and scarce means which have alternative uses,"[1] then all the activities of a local authority can be described as being in some degree, economic. The provision of education services entails the use of scarce means (land, labour, building materials) which could have been used for some other purpose, and is as fully an economic undertaking as the management of an electric power station.

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1. Robbins - "An Essay on the Nature and Significance of Economic Science", p.16.

Both these undertakings serve what is ultimately an economic end or a consumer damand and involve the making of an economic decision - the allocation of scarce resources to provide these particular services, and the sacrifice of the alternative satisfactions which the resources could have yielded. Similarly it is difficult to find any adequate reasons for describing, for example, the provision of public market facilities as a productive undertaking, while denying this description to a public drainage scheme. Even such duties of a local authority as running elections and providing for child welfare, though they may be regarded as mainly 'social' or 'political' in nature, come within the sphere of economic activity. This particular basis for the classification of the services of a local authority, although it has been used to distinguish trading from non-trading undertakings, must, then, be rejected as having no particular significance.

A second feature which might distinguish trading undertakings is that they include services which have been, or could have been, undertaken by private enterprise. This idea is introduced by Professor Haldane into a definition of the Public Corporation - "a body not making a divisible profit, and engaged in commercial operation which had previously been, or at least might

previously have been, carried on by private enterprise."[1] This basis of distinction seems somewhat vague and is an uncertain guide in classifying the activities of local authorities. Some services, which, from the financial viewpoint discussed later, are certainly not trading undertakings, might have been managed by private enterprise under certain circumstances. It is not inconceivable that even such a service as public lighting, despite the difficulties of apportioning charges amongst consumers, might have been provided by a private undertaking. The intermediate stage, where a company acts as an agent for a local authority in providing public lighting is, of course, quite a common arrangement.[2] Furthermore, even if a particular service has been managed by private enterprise this does not necessarily mean that it will retain its 'trading' nature when taken over by a local authority. Elementary education has been, and still is, provided in Private Preparatory Schools as a profit-making enterprise, but no one will suppose that this makes it necessary to classify the activities of a local education authority as a trading undertaking.

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1. Haldane - Public Enterprise (Edited Robson).
2. See for example, Lighting and Watching Act, 1833.

A third possible means for differentiating between the trading and other activities of local authorities might be based on the Local Government Financial Statistics published by the Ministry of Health These returns are given in three main Tables - I, Rate Fund, II, Trading Services and Corporation Estates and III, Special Funds. The list of services included under the heading Trading, in the Statistics for 1943-44 was - Water supply; Gas supply; Electricity supply; Transport (tramways, etc.); Cemeteries, Harbours, docks, piers and canals; Miscellaneous (including ferries and markets). This Table is useful as giving an official list of what are considered to be trading services, but it cannot be accepted without question, and has certain limitations. The reasons for the classification are not given, and may be based on little more than convenience and convention. The position of Cemeteries as a strictly trading undertaking, is, for example, at least open to some debate.[1] Some services which are excluded seem to have quite as good a claim as Cemeteries to be classified as trading undertakings - for example certain parts of the functions of local authorities under the heading Baths, Washhouses and Open Bathing Places, and Parks, Pleasure Grounds

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1. Cf. p. 73.

and Open Spaces which are included under Rate Fund Services. The official list is also unsatisfactory in that it does not specify the items included under the heading 'Miscellaneous', and it is often these services which are most difficult to classify.

The fourth criterion of a trading service, and the only one which does provide a realistic basis for classification, is found in the method by which the undertaking raises its revenue. If the undertaking is (normally) financially self-supporting, and not dependent on any kind of subsidy from taxation, then this is an important distinction from a social service supported from taxation. If it is the policy of the undertaking that the full cost of supply must be recovered in charges from the consumer then this must have an important influence on the nature and actions of the management. Even this distinction is not, however, quite so clear and free from qualifications as it may appear at first sight. Firstly the way in which the revenues is obtained must be considered. If the charges made to consumers do not bear some relation to the amount (or quality) of his consumption then the distinction between the 'trading' and 'social service' principle may be blurred. If consumers of gas were charged according to the size of their income rather than that of their consumption of gas,

then the 'trading' nature of the enterprise would be affected, even although the revenue raised was sufficient to cover all costs. The charges for water supply made by a water rate depending not upon consumption, but on the rateable value of the house supplied,is an example of a service for which normal commercial principles of charging may be somewhat modified and which may contain some elements of a social service, supplying the poorer consumers at less than average cost and 'overcharging' more wealthy consumers.

Secondly, the consumer must be free to choose not to consume should he so wish. There are two important distinctions between a tax-supported and a self-supporting undertaking. One is that the tax may also fall on non-consumers or have no relation to the amount of consumption. The other is that it is compulsory. The consumer cannot avoid it by ceasing to consume. Thus even if a service like Public Lighting was paid for by a flat tax levelled on all inhabitants of the area where the lighting was 'consumed' this would still not make it a 'trading' service since consumption would be, in effect, compulsory.

Thirdly, there is the difficulty that local authority services do not, in fact, fall into two clearly distinct groups, -self-supporting and rate-aided. There is rather a gradation from those which are entirely dependent on

rate-aid or government subsidy through some which recover increasing proportions of their costs from consumers to those which are entirely self-supporting, or even produce a net surplus. To complicate the issue still further there is the problem of the water industry, where average figures taken for the whole country are quite misleading. Generally speaking water supply is self-supporting in the town but very much dependent on rate-aid in country districts.

At this point a digression may be made to consider the meaning of the phrase 'public utility'. Professor Robson has defined the "public utility concept" as involving "... the idea of an essential service requiring either public ownership or public regulation in the interests of the consumers and of the general public. It also implies the existence of privilege or monopoly rights."[1] Although both the gas and electricity industries are public utilities this particular basis of distinction cuts across the categories of public and private enterprise described above (private operation with some public control; public ownership of self-supporting enterprise; and public ownership with dependence on taxation). Gas, water and electricity undertakings are

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1. Robson "The Public Utility Service", in A Century of Municipal Progress, p.299.

still public utilities whether they are companies, local authorities or public corporations. On the other hand some publicly operated services - for example Civic Restaurants - are not public utilities. The chief relevance of the public utility nature of the industries examined in this study is in considering the reasons for the development of public control or ownership.[1]

Existing definitions of municipal trading and of Public Corporations have stressed the vital point of financial independence, but have not always made all the qualifications and complications very clear. Thus Sir Henry Bunbury has defined the Public Corporation as "An institution for producing goods or rendering services under the general condition that the cost of doing so is met from the revenue earned by doing so; - i.e. it has no taxing power." But this does not allow for certain awkward cases. For example the British Overseas and British European Airways Corporations are entitled to receive Exchequer grants until 1956 and the B.B.C. receives a grant to cover the cost of its overseas broadcasts. Professor Knoop's study of municipal trading

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1. Cf. p. 2 et seq.

contains this definition "... where it is intended by a local authority that the cost of one of its economic undertakings shall be met entirely out of the receipts, obtained by the sale of the product or service in question, a trading enterprise clearly exists..."[1] Professor Knoop then qualifies this definition by considering the case of 'economic' undertakings which are deliberately subsidised by local authorities. He makes a distinction between all economic undertakings and those which do not require a subsidy. These statements do not wholly solve the problem as the meaning of the word 'economic' is left rather uncertain. Professor Knoop does indeed suggest that the term might be confined to those undertakings which serve the individual rather than the whole community. This concept of the meaning of the word is unsatisfactory, not only because it conflicts with that generally accepted today, but also because it would include some services, such as Education, which Professor Knoop himself admits should be excluded. The other feature which he associates with being economic - absence of a subsidy payment, merely takes us back to where we started, and does not throw any further light on the problem of those services which are only partly self supporting financially. Mr.

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1. D. Knoop - Principles and Methods of Municipal Trading, p.2 et seq.

Clarke, in his well-known work on Local Government states that municipal trading is "A term applied to those services for which local authorities make a charge to the persons benefitted."[1] He adds that it should also include services which "though not expected to be profitable, might reasonably be expected to support themselves independently of the rates." In this category he would include Housing and Private Street Works. The definition of the term itself seems to be too wide. Some Public Libraries make a small charge to borrowers; and public bath and washhouse facilities are not usually provided entirely free, but neither of these services can be classified as trading without question. The concept of some services which might be 'expected' to support themselves without rate aid appears to be too vague for practical purposes of classification.

Mr. Clarke then proceeds to give an interesting classification of trading services based on their monopoly character, and whether they yield a profit. His four classes are:-

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1. Clarke - Outlines of Local Government in the U.K., p.69.

(a) Monopoly with profit.

(b) Monopoly but no profit - e.g. water, cemeteries.

(c) No monopoly, but profit - e.g. gas by-products.

(d) No monopoly and no profit - e.g. baths, housing.

The criterion of financial independence may now be used to show the actual position of both the gas and electricity industries and of the other main services operated by local authorities before the passing of the post-war nationalisation measures.

Three main sets of figures are useful here - those for all local authorities contained in the Local Government Financial Statistics of the Ministry of Health, figures for individual authorities of costs and revenue, and those showing the number of cases in which payments from the rates have been necessary. The services are taken in the order in which they occur in the Local Government Financial Statistics.

The 'social' services can be soon dismissed. The financial position of eight of these is given in the following Table.

Table 1. Financial position of municipal social services.

SERVICE	TOTAL EXPENSES(a)	REVENUE	GOVT. GRANTS	FROM RATES
Year ended 31st march 1937. County Councils only				
Elementary Education	26.1	.5	13.4	12.2
Higher Education	12.5	1.7	5.3	5.5
Public Libraries	.3	.02	-	.3
Poor Relief	20.5	2.8	1.1	16.6
Highways and Bridges	25.3	.6	8.5	16.3.
Police	7.9	.9	3.8	3.2
1943-44. All local authorities				
Elementary Education	89.2	4.9	43.7	40.6
Higher Education	31.3	5.6	12.6	13.0
Public Libraries	3.9	.35	.01	3.5
Poor Relief	28.3	3.2	.13	25.0
Highways and Bridges	38.9	3.1	5.3	30.5
Police	36.0	1.1	20.6	14.4

(a) Including Loan Charges.

There are three items under the general heading of Rate Fund Services which need further consideration, as they fall into the category of semi-trading services.

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1. Compiled from Local Government Financial Statistics, 1936-37 and 1943-44.

Two of these are sub-headings of the item Public Health, 'Baths, washhouses, and open bathing places' refers to a mixed group of services, some at least of which are of a trading or semi-trading nature. The figures for all local authorities were:-

Table 2. Financial position of municipal 'Baths, washhouses and open bathing places.[1]

		1940-41	1943-44
Total expenditure	=	£3,095,225	£3,395,296
Revenue	=	1,021,173	1,301,897
Govt.Grants	=	36,220	43,576
Rate fund burden	=	2,037,832	2,049,823

Of the items included under this heading it is the provision of public swimming baths which most nearly approximates to being a trading concern. Some individual examples of the financial position of swimming bath undertakings show, however, that these are a long way from being self-supporting and must fall into the semi-trading category.

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1. L.G.F.S. 1940-41 and 1943-44.

Table 3. Financial position of municipal swimming bath undertakings[1]

Date	Type of local authority	Name of town	Expenditure	Revenue	Deficit
1946-47	Municipal (Non-County Borough)	Darwen	£3,668(a)	£1,390	£2,278
1945-46	County Borough	Plymouth	£18,061(a)	£8,220	£9,841
1947-48	Urban District Council	Exmouth	£ 763(b)	£ 749	£ 14
1945-46	County Borough	Birmingham	£164,983	£58,309	£106,674

(a) Excludes loan charges

(b) Excludes loan and administrative charges.

The second of the sub-headings under Public Health which includes some services of semi-trading nature is Parks, Pleasure Grounds, and Open Spaces. The overall figures for these services are shown in Table 4.

Table 4. Financial position of municipal Pleasure Grounds and Open Spaces[2]

	1940-41	1943-44
Total expenditure	£6,178,983	£6,610,770
Revenue	977,619	1,359,468
Government Grants	60,529	79,058
Rate fund burden	5,140,835	5,172,244

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1. Based on: Borough of Darwen, Treasurer's A/C. 1946-47.
County Borough of Plymouth, Abstract of Accounts. Year Ending 31st March, 1946.
Exmouth U.D.C. Abstract of Account, 1947-8.
City of Birmingham Handbook, 1947.

2. 1940-41 and 1943-44.

These figures are, however, somewhat misleading, as some of the items included - the provision of parks and recreation grounds - are obviously purely 'social' services, adding considerably to expenditure but bringing in very little revenue. It is the provision of certain entertainments in the parks, and on the beaches of holiday resorts, which are of a semi-trading nature. The following figures illustrate the position of individual undertakings:-

Table 5. Financial position of certain municipal entertainments services[1]

Service	Type of authority	Date	Expenditure	Revenue	+ or - net
Chairs and Musical Performance	C.B.Plymouth	1945-6	£1,180[(a)]	£1,847	+ £667
Bowling green	M.B.Darwen	1946-7	155[(a)]	50	- 105
Tennis, bowls and golf	Exmouth U.D.C.	1947-8	973[(b)]	1,164	+ 191

Notes (a) Excluding loan charges

(b) Excluding loan and administrative charges

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1. Compiled from Abstracts of Accounts of Darwen N.C.B. 1946-7; Plymouth C.B. 1945-6; Exmouth U.D.C. 1947-8.

The other item under the heading of Rate Fund Services in the Local Government Financial Statistics which needs special consideration is Housing. Housing is really a semi-trading service, meeting about 60% of total expenditure from revenue. Rents are directly related to expenditure, but are not intended to make the service self-supporting - there is a permanent subsidy from rates and government grants. The figures for all local authorities in England and Wales for two recent years were:-

Table 6. Financial position of municipal Housing.

	1940-41	1943-44[1]
Maintenance and other expenses	£ 9,650,275	£10,187,233
Loan charges	32,562,770	31,645,247
Total expenditure	42,213,045	41,832,480
Revenue	24,709,352	25,158,902
Government Grants	13,508,325	12,580,425
Rate fund burden(a)	3,995,368	4,093,153

Note (a) Actual R/F contribution was greater than this as some local authorities increased balance on Housing Revenue Account during the year.

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1. L.G.F.S., 1940-41 and 1943-44.

Figures for the individual authorities are shown in Table 7.

Table 7. Financial position of individual Housing authorities.

Authority	Year	Expenditure	Revenue	Deficit[1]
M.B.Darwen	1946-7	£ 9,733(a)	£ 5,499	£ 4,234
C.B.Birmingham	1944-5	1,499,593	1,017,145	482,448
U.D.C.Exmouth	1947-8	10,736	6,692	4,044

Note: (a) Including loan and tax charges.

The provision of Housing by local authorities is a vast subject with unique problems of its own. The local authority must be sufficiently interested in the financial stability of its Housing schemes to relate rents to expenditure, particularly of course to the most important item of expenditure, loan charges on the money borrowed to construct the houses. But it has always been recognised that rent charges which would meet the total costs of supply were socially undesirable, and the difference has been made up from the General Rate Fund, and to a varying degree, from grants from the government. The local

1. Compiled from Abstracts of Accounts of: Darwen N.C.B. 1946-7; Exmouth U.D.C. 1947-8; City of Birmingham Handbook 1947.

authorities have not been able to choose their tenants, as they have their gas or electricity consumers, simply by their ability to pay for the service which they have received. The main problem of Housing Finance has been the size of the grant which the government have been willing to make. The main problems of local administration have been mainly 'social' questions - what kind of tenants should be admitted to Council Houses; what amenities should be provided on a Housing Estate.

One other service which the Local Government Financial Statistics list as 'Rate Fund' may be conveniently dealt with at this point - 'Private Street works and other works of private improvement'. Purely on a basis of the relationship of income to expenditure this appears to be a full trading service. The figures for two recent years are shown in Table 8.

Table 8. Financial position of 'private street works'.

		1940-41		1943-44[1]
Expenditure		2,394,603		1,887,449
Revenue		2,405,641		1,997,881
Government grants		17,679		7,483
Rate fund Burden	Cr.	28,717	Cr.	117,915

1. L.G.F.S. 1940-41 and 1943-44.

Private street works can, however, be excluded from the category of trading services, as the payment made is a compulsory, and not a voluntary charge. The usual practice is for a local authority to give the residents in an 'unadopted' road notice to improve the road, and when, as is almost invariably the case, nothing is done, to carry out the work themselves and recover the cost from the owners of frontage on the road concerned. (Local authorities may take action for the improvement of private streets either under the Public Health Acts, 1875-1936, or under the Private Street Works Act, 1892.) This procedure approximates more nearly to the levying of a local rate than to a trading charge, and Private Street Works cannot be considered as a trading service.

Two other services which fall under the rate-fund category have some 'trading' characteristics. These are municipal hostels and salvage. Municipal hostels are rate-fund services erected under the Housing of the Working Classes Act, 1890 and subsequent Public Health Acts, but a charge is made to those using these facilities which makes the service partly self-supporting. The following figures show the position of the Darwen Municipal Hostel in 1946-7.[1]

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1. Borough of Darwen, Treasurer's Accounts, 1946-7.

Working expenses - £2,428

Income - £1,785

Rate subsidy - £ 642

The position of salvage schemes depends upon what allowance is made for the cost of collection. On the sale of the salvage itself a profit may be made, but this is never sufficient to cover the cost of the collection of all waste material Mr. T. Sturdy, the Cleansing Superintendent of York Corporation has written in an article on Salvage that - "No separate salvage collection, scheme, costed fairly, can be termed in itself a sound business proposition."[1] The figures for the York undertaking, given by Mr. Sturdy are shown in Table 9.

Table 9. Financial position of York Salvage Scheme.[2]

	1937-8 £	1946-7 £
Cost of refuse collecting and disposal at destructor and refuse tips.	20,003	18,862
Cost of salvage collection and preparing for sale	567	23,005
TOTAL	20,570	41,867
Revenue from Salvage	631	18,549
Net cost of whole scheme	19,939	23,318
Net cost of salvage scheme Cr.	64	4,456

1. T. Sturdy "Salvage" Municipal Review, Jan.1948.

2. Ibid.

It is now necessary to consider the services which are listed as 'Trading' in the Local Government Financial Statistics. The first of these, water, is the service about which it is most difficult to generalise. Recent figures for all local authorities in England and Wales are shown in Table 10.

Table 10. Financial position of municipal water undertakings.[1]

Working expenses[(a)]	14,979,841	16,775,635	23,306,000
Loan charges	10,450,754	10,407,436	9,996,000
Total expenditure	25,430,595	27,183,071	33,302,000
Transfers in aid of rates	100,193	101,358	304,000
Revenue	23,677,325	26,177,125	32,555,000
Government grants	208,903	224,353	94,000
Rate fund contribution	1,483,327	1,455,339	1,920,000
Net R/F contribution	1,383,128	1,353,981	1,616,000

Note: (a) Including transfers to special funds and to capital accounts.

These figures do not, however, tell the whole story. There is no uniform local authority policy on water charges.

1. L.G.F.S. 1940-41, 1943-44 and 1948-49.

Some authorities attempt to make revenue from consumers equal to the cost of supply, while others are content to budget for a persistent deficit which must be met from the rate fund. Generally speaking there is a fairly definite cleavage between urban and rural authorities. The larger towns can usually make their water undertakings nearly or entirely self-supporting, while in the country, or more scattered urban areas, the cost of provision is so high that to recover this direct from the consumer is out of the question. This may be illustrated by the figures of authorities of different types.

Table 11. Financial position of individual rural and urban municipal water undertakings.[1]

Date	Type of local authority	Expenditure (Figures to nearest £1.)	Revenue	Surplus or Deficit	Transfers from rates
1945-46	C.B.Plymouth	Net deficit after loan and income Tax dedtns.		(Deficiency met from Reserve Fund) £ 1,962	Nil
1946-47	M.D.Darwen	£ 27,013	29,209	+ 2,196	
1947-48	Joint Board, Kingsbridge & Salcombe (2.U.D.C., I.R.D.C.)	13,068	1,287	-11,780	-11,780
1947-48	U.D.C.Exmouth	21,586	15,394	- 6,191	- 7,750
1947-48	C.B.Birmingham	1,194,642	1,240,535	+45,892	Nil

1. Compiled from Abstracts of Accounts of: Plymouth C.B.1945-6; Darwen M.C.B.1946-7; Kingsbridge & Salcombe Water Board,1947-48; Exmouth U.D.C.1947-48; Birmingham C.B. Report of the Water Committee, 1947-48.

The position of water undertakings can also be illustrated from the number of authorities which have been obliged to make subsidies from the rates to support them, taken from the sample included in the Preston Rate Return, 1946-47.

Table 12. Municipal water undertakings aided from Rate Funds 1946-47.[1]

Authority	No. in sample	No.with service	No. of R/F cont.	% with R/F cont.
County Boroughs	83	64(a)	10(b)	15.6
Municipal (Non County)Boroughs	169	133(c)	19	14.3
Urban District Councils	78	52(d)	26	50.0

Notes: (a) Including II Joint Boards

(b) Including payments to 3 Joint Boards

(c) Including 49 Joint Boards

(d) Including 12 Joint Boards

The next service, gas supply, falls clearly into the trading group. The figures for three recent years are shown in Table 13.

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1. 'Rates Levied in Various Towns' 1946-7. (Return made by Borough Treasurer of Preston, also known as 'Preston Rate Return'.

Table 13. Financial position of municipal gas undertakings.1

	1940-41	1943-44	1948-49
Working expenses(a)	18,341,887	25,965,445	44,427,000
Loan Charges	2,488,075	2,163,393	2,437,000
Total expenditure	20,829,962	28,128,838	46,864,000
Revenue	20,868,805	28,509,947	46,823,000
Government Grants	53,392	111,706	8,000
Transfers from rates	105,183	55,628	99,000
Transfers to rates	67,589	55,223	155,000
Net Transfers to (+) or from (-) rates	- 37,594	- 405	+ 76,000

Note (a) Includes transfers to special funds and capital accounts

Individual examples of the financial position of gas undertakings, belonging to different types of local authority further illustrate the generally self-supporting nature of this service:

1. L.G.F.S. 1940-41 and 1943-44.

Table 14. Financial position of individual municipal gas undertakings.[1]

Date	Type of Local Authority	Expenditure	Revenue	Net Surplus or Deficit	Rate Transfers
1946-47	Darwen M.B.	£ 114,279	£ 115,739	1,460	5000 to rates reduction Appropriation A/c. Balce,
1947-48	Birmingham C.B.	5,400,142	5,690,149	+290,007	
1945-46	Plymouth C.B.	-	-	+ 6,834	Nil
1945-46	Manchester C.B.	2,214,805	2,165,617	- 49,188	Net from previous balance
1945-46	Malvern U.D.C.	93,034	90,053	- 2,981	do.

Figures for County Boroughs, Non County Boroughs and Urban Districts, taken from the Preston Rate Return sample, show that, in 1946-47, only two Urban Districts needed to transfer sums from the General Rate Fund in aid of the gas undertaking.

1. Compiled from Abstracts of Accounts of: Darwen N.C.B. 1946-47; Plymouth C.B. 1945-46; Birmingham C.B. Gas Committee, Report to Council, 1947-48; Manchester 'The City's Finances', 1945-46; Malvern - accounts of gas undertaking.

Table 15. Municipal gas undertakings aided from Rate Funds 1946-7.[1]

Authority	No.in sample	No.with service	No.of R/F cont.	% with R/F cont.
County Boroughs	83	38(a)	Nil	Nil
Non County Boroughs	169	52(b)	Nil	Nil
Urban District Councils	78	26	2	7.69

Notes: (a) Excluding Southend

(b) Including 1 Joint Board

The position of electricity supply, the next service listed in the Local Government Financial Statistics, is very similar to that of gas.

Table 16. Financial position of municipal electricity undertakings.[2]

	1940-41.	1943-44
Working expenses(a)	47,069,530	63,763,080
Loan charges	17,623,011	17,669,555
Total expenditure	64,692,541	81,432,635
Revenue	64,929,071	82,417,703
Government Grants	149,418	107,633
Transfers from rates	10,434	173,210
Transfers to rates	373,377	249,185
Net transfers to or from rates	+ 362,943	+ 75,975

Note: (a) Including transfers to special funds and to capital accounts

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1. 'Rates Levied in Various Towns' 1946-47.

2. 1940-41 and 1943-44.

Individual examples are shown in Table 17

Table 17. Financial position of individual municipal electricity undertakings.[1]

Date	Type of Local Authority	Expenditure	Revenue	Net Surplus or Deficit	Rate Transfers
1944-45	Birmingham C.B.	£4,670,689	£4,703,820	+ 33,131	Nil
1945-46	Plymouth C.B.	-	-	+ 14,765	Nil (Met from Reserve fund)
1945-46	Manchester C.B.	2,985,115	2,914,995	- 70,120	Nil (Met from appropriatn. Fund)
1946-47	Darwen M.B.	89,392	84,842	- 4,550	Nil

Although in two of the examples given above losses were made in the year chosen, this was obviously exceptional, as there were, in each case, ample reserve funds to meet the loss, and it was not necessary to draw on the rate fund. There are no cases, amongst the local authorities included in the Preston Rate Return of 1946-47, of any

1. Compiled from Abstracts of Accounts of Plymouth and Darwen; Manchester 'The City's Finances, 1946'; Birmingham Handbook 1947.

transfers from the rates being necessary to support an electricity undertaking.

Table 18. Municipal electricity undertakings aided from Rate Funds, 1946-47.[1]

Type of authority.	No.in sample	No.with service	No.of R/Fcont.	% with R/F cont.
County Boroughs	83	75	Nil	Nil
Non-County Boroughs	169	108	Nil	Nil
Urban District Councils	78	39(a)	Nil	Nil

Note: (a) Including 2 Joint Boards

The last of the 'Big Four' of municipal trading included on the Local Government Financial Statistics list is Transport.

Table 19. Financial position of municipal transport undertakings.[2]

Working expenses(a)	£23,912,922	£32,601,936
Loan charges	3,032,987	2,437,883
Total expenditure	26,945,909	35,039,819
Revenue	27,037,903	35,337,059
Government grants	22,672	11,066
Transfers from rates	206,023	17,532
Transfers to rates	218,084	246,763
Net transfer to or from rates	+ 12,061	229,231

Note: (a) Including transfers to special funds and to capital accounts.

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1. 'Rates levied in various towns' 1946-47.
2. 1940-41 and 1943-44.

This Table shows that the degree of rate subsidisation was comparatively small, and that in both the years shown the transport undertakings were not contributors to the rates. A factor which is disguised by these figures is that it has usually been more difficult to make tramway undertakings pay than it has to run omnibus and trolleybus services on a self-supporting basis. The deficit on tramways has often been made good, however, not from the rate fund but from the surplus on omnibus services managed by the same authority. These facts are illustrated by the figures for individual undertakings which follow.

Table 20. Financial position of individual municipal transport undertakings.1

Date	Local Authority	Expenditure	Revenue	Net Surplus or Deficit	Rate Transfers
1947-8	Birmingham C.B.	£4,823,996	£4,882,907	+58,912	Nil (Reserve fund)
1945-6	Manchester C.B.	3,787,778	3,713,879	-73,899	Nil
1945-6	Plymouth C.B.	-	-	+67,880	Nil
1947-8	Walsall C.B.	575,414	604,852	+29,438	Nil (Reserve fund)
1946-7	Darwen N.C.B.	58,328	58,617(a)	+ 289	+ 1000

Note: (a) Not including interest on investments payable to Joint Undertaking of £469

1. Compiled from Abstracts of Accounts of Plymout and Darwen; Committee Reports on Birmingham, Walsall, booklet on "The City's Finances", Manchester.

It is interesting to note that Darwen paid a larger sum in aid of the General Rate than the total net surplus (even if the £469 Interest on Investments Payable to Joint Undertaking is included in this), for the year, by means of reducing the Appropriation Account balance.

The subsidisation of tramway undertakings from the profits of omnibus and trollybus undertakings may be illustrated from the figures for Birmingham and Darwen. The net surplus of £58,912 for Birmingham's transport in 1947-8 was made up as follows:-

Motor omnibus - gross surplus	£579,236[1]
Trolley " - " "	12,800
	£592,036
Tramway undertaking, deficit	143,226
Gross surplus	448,810
Miscellaneous interest payments etc. credited to joint undertaking	9,434
	458,244
Less loan payments, income tax and depreciation	399,332
	£ 58,912

1. Birmingham Transport Committee, Report to Council 6th July, 1948.

The position for Darwen was:-[1]

Net profit - Omnibuses	£	775
Loss - Tramways		486
	£	289
Plus interest payments		469
Total net surplus	£	758

The figures for the gross surpluses on the Birmingham Tramway Accounts show that, although the deficit for 1947-48 was unusual (a strike in November 1947 reduced the surpluses of all three transport services) the trend was for the surplus to decrease in size. Separate figures for loan and tax charges and depreciation are not given, but it seems probable that in several years these would have converted the gross surplus into a net loss. Figures for the gross surpluses for the omnibus undertaking are given for comparison. The gross surplus per car mile run declined continuously except for the two years 1942-3.

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1. Borough of Darwen. Abstract of Accounts. 1946-7.

Table 21. Gross surplus or deficit, and miles run, Birmingham Tramways and Omnibus Undertakings, 1935-48.[1]

Year	Car/'Bus Miles Run		Gross surplus or deficit		Gross surplus or loss mile run	
	Tram Millions	'Bus Millions	Tram £	'Bus £	Tram d.	'Bus d.
1935	16.5	18.7	+ 232,940	+ 262,429	+ 3.388	+ 3.558
1936	16.7	19.5	+ 214,181	+ 308,309	+ 3.079	+ 3.795
1937	16.3	22.3	+ 199,692	+ 333,015	+ 2.942	+ 3.584
1938	15.2	26.5	+ 176.729	+ 355,449	+ 2.790	+ 3.219
1939	14.3	27.4	+ 138,893	+ 360,750	+ 2.332	+ 3.159
1940	11.7	28.6	+ 73,668	+ 440,580	+ 1.511	+ 3.698
1941	10.9	29.1	- 14,224	+ 360,711	- 0.3132	+ 2.974
1942	10.7	30.9	+ 62,306	+ 694,984	+ 1.497	+ 5.397
1943	11.1	30.7	+ 131,863	+ 885,153	+ 2.852	+ 6.918
1944	11.2	29.0	+ 97,251	+ 752,828	+ 2.084	+ 6,230
1945	11.1	29.9	+ 77,945	+ 787,006	+ 1.685	+ 6.404
1946	11.3	31.5	+ 35,165	+ 671,828	+ 0.7466	+ 5.118
1947	11.4	33.7	+ 12,029	+ 706,370	+ 0.2533	+ 5.030
1948	10.9	34.4	- 143,226	+ 579,236	- 3.153	+ 4.041

These figures may be compared with those showing a division of all local authority tramway undertakings in Great Britain into six classes, according to their financial position.

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1. Compiled from Birmingham Transport Committee, Report to Council, July 1948.

Table 22. Relation of income to expenditure for all local authority tramway undertakings in Great Britain, 1933-34-1937-38.[1]

Classes:-

Class I = Undertakings which showed a credit balance for the year after meeting all charges including Capital Redemption and Reserves.

Class II = Undertakings which after meeting all charges, including Capital Redemption, made Reserves in excess of the amount available from the year's working.

Class III = Undertakings which after meeting Interest and Capital Redemption were unable to meet Income Tax and other appropriation charges in full.

Class IV = Undertakings which, after meeting Interest charges were unable to meet Capital Redemption in full.

Class V = Undertakings which were unable to meet interest charges in full.

Class VI = Undertakings which were unable to meet their working expenses.

CLASS	NUMBER OF UNDERTAKINGS									
	1933-4		1934-5		1935-6		1936-7		1937-8	
	No.	%	No.	%	No.	%	No.	%	No.	%
I	69	65.7	65	73.0	58	74.4	55	80.9	49	79.0
II	5	4.8	4	4.5	4	5.1	2	2.9	4	6.5
III	5	4.8	4	4.5	5	6.4	6	8.8	6	9.7
IV	19	18.1	15	16.9	9	11.5	3	4.4	2	3.2
V	6	5.7	1	1.1	2	2.6	1	1.5	1.	1.6
VI	1	0.9	-	-	-	-	1	1.5	-	-
TOTAL:	105	100.0	89	100.0	78	100.0	68	100.0	62	100.0

1. Compiled from Ministry of Transport Tramways and Light Railways and Trolley Vehicle Undertakings Returns, 1937-38.

Table 23. Municipal transport undertakings aided from Rate Funds, 1946-47.[1]

Type of authority	No. in sample	No.with service	No. of R/F cont.
County Boroughs	83		Nil
Non County Boroughs	169		1
Urban District Councils	78		2

The fifth 'trading service on the Local Government Financial Statistics list is Cemeteries.

Table 24. Financial position of municipal cemetery undertakings.[2]

	1940-41	1943-44	1948-49
Working expenses[(a)]	£1,768,211	£2,010,053	£3,486,000
Loan charges	283,049	280,432	218,000
Total expenditure	2,051,260	2,290,485	3,704,000
Revenue	1,415,636	1,526,927	2,076,000
Government grants	3,514	5,171	10,000
Transfers from rates	645,849	790,657	1,597,000
Transfers to rates	13,821	17,126	1,000
Net transfer to (+) or from (-) rates	- 631,528	- 773,531	-1,596,000

Note: (a) Including transfers to special funds and to capital accounts.

1. Compiled from 'Rates Levied in various towns', 1946-7.

2. 1940-41, 1943-44 and 1948-49.

These figures show that Cemeteries were not self-supporting, and needed a comparatively large rate subsidy

Table 25. Financial position of individual municipal cemetery undertakings.1

Date	Local Authority	Expenditure	Revenue	Net Surplus or Deficit	Rate transfer
1945-6	Plymouth C.B.(a)	-	-	+£1,844	+£1,844
1945-6	" " (b)	-	-	- 376	- 376
1946-7	Darwen N.C.B.	£3,934	£2,578	- 1,356	- 1,356

Notes: (a) Burial Fund

(b) Cemeteries Fund

Table 26. Rate transfers to meet deficits in cemetery undertaking accounts 1946-7[2]

Type of Authority	No.in sample	No.with service	No. of R/F contributions	% of R/F contributions
County Boroughs	83	83	74	89.2
Non County Boroughs	169	-	132	-
Urban District Councils	78	-	53	-

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1. Compiled from Abstracts of Accounts of Plymouth and Darwen.

2. Compiled from return of 'Rates Levied in Various Towns', 1946-47.

The next service on the Local Government Financial Statistics list is a composite group - Harbours, docks, piers and canals.

Table 27. Financial position of municipal harbours, docks, piers and canal undertakings.[1]

	1940-41	1943-44
Working expenses[(a)]	£ 9,097,259	£13,788,249
Loan charges	3,959,136	4,472,640
Total expenditure	13,056,395	18,260,889
Revenue	11,687,916	18,871,052
Government grants	288,241	335,483
Transfers from rates	257,583	243,215
Transfers to rates	4,491	3,036
Net transfer to or from rates	- 253,092	- 240,179

Note: (a) Including transfers to special funds and to capital accounts.

Although this group of undertakings was a burden on the rate fund in both the sample years, the relationship between total revenue and total expenditure was fairly close, the former exceeding the latter in 1943-44.

The figures for 1936-37, for each of the main types

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1. 1940-41 and 1943-44.

of local authority show that in each case the services require a considerable subsidy from the rates.

Table 28. Financial position of harbours, docks, piers and canal undertakings for County Boroughs, non County Boroughs, Urban and Rural district Councils in England, 1936-37.[1]

	C.B.	M.B.	U.D.C.	R.D.C.
Working expenses	906,981	£116,204	£34,405	£194
Loan charges	798,392	64,484	18,124	-
Total expenditure	1,705,373	230,688	52,529	194
Revenue	1,599,740	194,831	40,227	20
Government grants	79,176	3,397	547	-
Transfers from rates	141,281	50,797	16,006	174
Transfers to rates	11,415	2,621	2,906	-
Net transfer to (+) or from (-) rates	- 129,866	-48,176	-13,100	-174

Of the total of 20 county boroughs (including Wales) administering Harbours, Docks, Piers and Canals in 1936-37, 6 authorities transferred £11,838 to the rate fund while 12 drew £141,289 from the rates. The seventh, and final group of services included in the 'official' Local Government Financial Statistics list of trading services is 'Miscellaneous (including ferries and markets)

1. L.G.F.S. 1936-37.

The total figures of expenditure and income are given below, but their significance is obviously very limited in a group containing a number of diverse services.

Table 29. Financial position of miscellaneous group of Municipal trading undertakings [1]

	1940-41	1943-44	1948-49
Working expenses[(a)]	£4,458,010	£12,965,133	£11,047,000
Loan charges	1,110,983	1,023,012	838,000
Total expenditure	5,568,993	13,988,145	11,885,000
Revenue	4,965,604	13,666,931	11,516,000
Government grants	133,166	216,058	253,000
Transfers from rates	602,058	506,198	795,000
Transfers to rates	188,687	205,376	590,000
Net transfer to (+) or from (-) rates	- 413,371	- 300,822	- 205,000

Note: (a) Including transfers to special funds and to capital accounts.

The considerable increase in the size of total expenditure and of revenue between 1940-41 and 1943-44 is partly accounted for by the development of the British Restaurant service which was begun in 1940. The British (or Civic) Restaurant figures were shown separately in 1948-49.

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1. 1940-41 and 1943-44.

Trading services which are included in the miscellaneous group are:- markets; ferries; catering; entertainments; savings bank; car parks; airports; farms and estates; oyster fishery; hostels; public lifts; conditioning house; telephone; mineral springs; dairy; hydraulic power.

Markets include a number of ancillary businesses - the provision of abattoirs, cold air stores, ice factories and warehouses.

Table 30. Rate transfers of County Borough Market undertakings 1936-37.1

Number of undertakings	=	68
Number of transfers to rates	=	58
Number of transfers from rates	=	8
Amount transferred from rates	=	£ 16,078
Amount transferred to rates	=	£272,270
Net rate transfer	=	£256,192

Only a small minority of market undertakings needed to rely upon a rate subsidy in this year.

Four out of five County Borough ferry undertakings were self-supporting in 1936-37. Under this heading are

1. 1936-37.

included also similar methods of transport over water, - the 'floating bridge' at Southampton, and the 'Transporter Bridge' at Newport.

Table 31. Rate transfers of County Borough Ferry undertakings.[1]

Number of undertakings	=	5
Number of transfers to rates	=	Nil
Number of transfers from rates	=	1
Amount transferred from rates	=	£2,072
Amount transferred to rates	=	Nil
Net rate fund transfer	=	£2,072

Entertainments include beach services; orchestras; concert halls; piers (for pleasure purposes); racecourses; provision of various games (golf, tennis, bowls); and a number of other activities. The 'miscellaneous' trading activities of County Boroughs which can be placed under the general heading 'Entertainments' can be subdivided into four groups - beach services, concerts, concert halls and Pavilions, and miscellaneous. In 1936-37 total income exceeded total expenditure for the beach services group (and there was a net transfer in aid of rates) but

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1. L.G.F.S. 1936-37.

fell short of expenditure with the other three groups.

Table 32. Financial position of County Borough Entertainments services.[1]

I - Beach Services

Town	Working expenses £	Loan charges £	Total expendre. £	Revenus £	To rates £	From rates £
Bourne-mouth	73,552	7,140	80,692	99,478	17,797	-
Brighton	9,410	-	9,410	12,147	2,706	-
Gt. Yarmouth	4,716	-	4,716	10,909	6,193	-
Ports-mouth	42,414	6,445	48,859	40,100	-	8,926
Swansea	2,501	1,915	4,416	4,486	-	1,364
TOTALS:	132,593	15,500	148,093	167,120	26,696	10,290 +£16,406

II - Pavilions etc.

Town & detls.of service	Working expenses £	Loan charges £	Total expendre. £	Income £	To rates £	From rates £
Bourne-mouth Pa-vilion	132,978	18,270	151,248	152,766	-	2,643
Bourne-mouth Winter Gdns.	549	770	1,319		-	1,318
Brighton halls,etc.	2,514	744	3,258	2,533		785
Gt.Yar-mouth Pier Pavilion Gdns.	21,623	3,112	24,735	19,676	-	5,174
Swansea Pavilion	870	1,207	2,077	1,732	-	352
TOTALS:	158,534	24,103	182,637	176,707	-	10,272

1. Compiled from L.G.F.S. 1936-37.

Table 32 continued

III - Concerts

Town	Working expenses £	Loan charges £	Total expendre. £	Income £	To rates £	From rates £
Blackburn	627	-	627	289	-	338
Derby	1,126	-	1,126	958	-	173
Eastbourne	48,187	3,018	51,205	41,136	-	10,098
Plymouth	4,249	-	4,249	3,697	-	558
TOTALS:	54,189	3,018	57,207	46,000	-	11,167

IV - Miscellaneous

Town & Detls.of Service	Working expenses	Loan charges	Total expendre.	Income	To rates	From rates
Brighton Aquarium	18,172	9,775	27,947	25,117	-	4,373
Doncaster Racecourse	57,182	-	57,182	61,088	4,000	-
Eastbourne Sea bathing	4,865	542	5,407	6,553	2,000	-
Entertainments Hastings	47,926	7,712	55,638	46,378	802	10,555
Norwich	878	-	878	536	-	119
Entertainments Southend	20,168	463	20,631	22,002	1,371	-
Bands & Chairs Southport	21,827	3,475	25,302	18,368	-	7,395
Marine Lake	7,214	5,805	13,019	9,477	-	5,162
	178,232	27,772	206,004	189,519	8,173	27,604 -19,431

Some caution is necessary in interpreting these figures and in classifying the services, as their treatment in municipal financial statistics and returns is by no means uniform. Thus, in the above Table, Southend's 'Bands and Chairs' may be very much the same thing as Blackburn's Concerts. In the accounts of individual local authorities there is often no clear distinction in the treatment of trading or non-trading services. In the sphere of entertainment services in particular individual authorities sometimes include very similar services in different parts of their accounts. Thus a seaside resort includes bowls, tennis, and golf (under the heading 'Roads and Works Committee') in its General Rate Fund Account, but its cricket field, and miniature golf in the Beach and Foreshore Undertaking Account.[1] This confusion does not exist only in the treatment of Entertainment. Individual local authorities do not always follow the Local Government Financial Statistics in their classification of services under the headings 'Rate Fund' and 'Trading'. For example, Cemeteries and Markets, both of which come under the 'Trading' heading in the Local Government Financial Statistics of the Ministry of Health are usually included

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1. Exmouth U.D.C. Abstracts of Accounts, 1947-8.

by local authorities themselves in the General Rate Fund Account.[1] An entertainments service which is clearly unlikely ever to be self-supporting is the provision of orchestras. This has not always been realised but local authorities supporting orchestras are now aware that some rate subsidisation is essential. In an article on "Municipality and Orchestra" Mr. Steward Wilson, the Musical Director of the Arts Council of Great Britain wrote that music is an amenity which "... should be provided like libraries, art galleries and recreation, with a definite realisation that receipts will not equal costs."[2] Some towns have confined their interest in orchestras to making grants to independently managed bodies, but the tendency is now for those who 'pay the piper' to demand control.

The financial statistics of Civic Restaurants show that they have so far been nearly or entirely self-supporting. For the first three months of 1946-47 the gross takings for all Civic Restaurants (or British Restaurants, as they were then called) was £893,000, and the net profit (after providing for amortisation)

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1. Cf. for example Borough of Darwen, Treasurer's Accounts, 1946-47.

2. S.Wilson,"Municipality & Orchestra", Municipal Review, Oct. 1947, p.343.

was £36,000.[1] The period for the repayment of the loans granted by the Ministry of Food, eight and one third years, was very short and amortisation charges were therefore unduly high for British Restaurants. The trading surplus of the Londoner's Meals Service for 1945-6 was £91,132.[2] For 1947-8 the L.C.C. Restaurants made a net surplus, (untaxed) of £103,955. Out of 128 restaurants only 18 made losses.[3] The following Table shows the position of all Civic Restaurants in 1948-49.

Table 33. Financial position of Civic Restaurants, England and Wales 1948-49.[4]

Item	£
Working expenses(a)	5,538,000
Loan charges	45,000
Total expenditure	5,583,000
Revenue	5,430,000
Government grants	13,000
Transfers from rates	109,000
Transfers to rates	16,000
Net transfers to (+) or from (-) rates	- 93,000

Note: (a) Including transfers to special funds and to capital accounts.

1. Statement in House of Commons 28th November. Cited Municipal Review, December 1946, p.346.
2. Municipal Journal, August 15th 1946, p.1397.
3. Ibid., November 12th, 1948.
4. L.G.F.S. 1948-49.

Tynemouth Civic Restaurants made a net profit of £890 in 1946-7.[1]

The Bristol Restaurants made a net profit of £4,087 in the six months period to September 30th 1946.[2]

The Bath Restaurants made a net profit of £1,481 in the nine months to December 31st 1947.[3]

The position in Plymouth in 1945-46 was:[4]

Working expenses	=	£27,684
Amortization	=	933
Total	=	£28,617
Income	=	£30,161

Surplus to deficiency account = £1,544

Table 34 shows the position in Hull, which had a Restaurants undertaking before the development of British Restaurants, though the growth of these and of the school meals service is reflected in the figures from 1942.

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1. Municipal Journal, August 15th, 1946.
2. Ibid., January 2nd, 1948.
3. Ibid., May 2nd, 1948.
4. C.B. of Plymouth, Abstract of Accounts, Year ending 31st March, 1946.

Table 34. City of Kingston upon Hull - Restaurant Statistics 1932-46.

Year ending 31st Mar.	Income	Working expenses	Net Revenue charges	Net Surplus or deficiency [1]
1932	£ 13,471	£ 12,594	£ 47	+ 830
1933	16,417	15,392	180	+ 845
1934	15,815	15,258	158	+ 399
1935	16,765	16,712	35	+ 18
1936	18,091	17,622	44	+ 425
1937	19,895	19,392	63	+ 440
1938	21,173	20,460	81	+ 632
1939	20,852	20,178	94	+ 580
1940	21,317	18,603	178	+ 2,596
1941	20,506	18,105	2,776	- 375
1942	95,240	101,017	771	- 6,548
1943	85,964	103,930	1,356	- 19,322
1944	95,763	95,642	1,057	- 936
1945	87,913	88,319	730	- 1,136
1946	92,330	89,597	759	+ 1,974

The municipal bank of Birmingham was shown to be self-supporting, as would be expected, by the 1936-37 figures:-

1. Kingston upon Hull Restaurants Accounts, Year ended 31st March, 1946.

Working expenses	=	£765,048[1]
Income	=	784,331
To reserve	=	3,598

Municipal airports were clearly in the class of undertakings partly dependent on rate support in 1936-37. Of 34 county borough undertakings in 1936-37, 33 needed rate subsidies totalling £97,117. Only one undertaking (Exeter) was able to contribute the sum of £17 to rate relief. Eight undertakings paid £238 to reserves and 11 paid £9,863 from revenue to capital account.[2] Comparable figures for all non-county boroughs in 1936-37 were:-

Working expenses	=	£ 7,176[3]
Loan charges	=	6,306
		£ 13,482
Earned income	=	1,262
Deficit	=	12,220
To capital a/c	=	472
		£ 12,692

The telephone system operated by Hull has shown a consistent net surplus since 1932.

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1. L.G.F.S. 1936-37.
2. Ibid.
3. Ibid.

Table 35. City of Kingston upon Hull Telephones Statistics 1932-46.[1]

Year ending 31st Mar.	Income	Working expenses	Gross surplus	Net Revenue charges	Net surplus
1932	£124,852	£ 80,811	£ 43,771	£ 25,011	£ 18,760
1933	125,864	80,833	45,031	27,597	17,434
1934	126,415	81,527	44,888	15,682	29,206
1935	129,027	85,217	43,810	23,846	19,964
1936	134,377	88,217	46,160	25,203	20,957
1937	141,102	87,410	53,692	26,461	27,231
1938	147,633	95,139	52,494	30,199	22,295
1939	155,357	98,111	57,246	30,450	26,796
1940	163,495	98,718	64,777	22,422	42,355
1941	159,693	100,286	59,407	27,672	31,735
1942	151,655	108,139	43,516	29,628	13,888
1943	156,515	114,302	42,213	22,801	19,412
1944	167,366	123,574	44,062	19,435	24,627
1945	175,815	120,199	55,616	22,700	32,916
1946	178,761	124,475	54,286	20,876	33,410

The financial position of the other miscellaneous trading undertakings of county boroughs in 1936-37 is given in Table 36.

1. Kingston upon Hull, Telephone accounts - year ended 31st March, 1946.

Table 36. Financial position of Miscellaneous trading undertakings County Boroughs 1936-37.

Town & details of service	Working expenses £	Loan charges £	Total expendre £	Income £	To rates	From rates
Bath - Mineral Springs	36,592	3,693	40,285	27,545	-	-
Bradford - Conditioning house	43,870	7,715	51,585	63,735	-	-
Wolverhampton Cold Stores	2,473	2,562	5,035	3,843	-	-
Worcester Dairy	611	-	611	808	-	-

Municipal estates and farms having a trading element in them when produce from them is sold. The mere ownership of land and property, however, cannot be regarded as a trading function.

The Local Government Financial Statistics include Corporation Estates in the same Table as Trading Services, though as a distinct item. The financial position for all local authorities is given below:-

Table 37. Financial position of 'General Corporation Estates'.[1]

	1940-41	1943-44	1948-49
Working expenses[(a)]	879,622	1,106,304	1,707,000
Loan charges	533,068	553,369	617,000
Total expenditure	1,412,690	1,659,673	2,324,000
Revenue	1,563,744	1,534,346	2,069,000
Government grants	5,927	13,839	9,000
Transfers from rates	201,058	386,994	566,000
Transfers to rates	360,187	247,565	324,000
Net transfers	+ 159,129	- 139,429	- 242,000

Note: (a) Including transfers to reserve and capital accounts.

Of 60 County Boroughs with corporation estates in 1936-37, 32 contributed £302,318 to the General Rate Fund, while 26 required subsidies totalling £82,193.[2] Non county boroughs in 1936-37 had a total expenditure of £219,310 and an income of £252,338 for all corporation estates. They contributed £64,699 to the Rate Fund and drew £48,532 from it.[3]

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1. L.G.F.S. 1940-41, 1943-44 and 1948-49.
2. L.G.F.S. 1936-37.
3. Ibid.

On the basis of the degree to which they are financially self-supporting the main 'social' services and all the 'trading' services are placed in rank in the Table below (38). There was a cluster of services which obtained less than 12% of their expenditure back as earned revenue. These were clearly 'social', rate supported services. Four services came in the intermediate group of what might be called 'semi-trading' services, the actual range of percentages of expenditure covered by earned revenue ranging from 21-65. The final group of the more obviously 'trading' services (with the exception of the anomalous position of water supply) showed a range from 96-103%.

The percentages shown are those of earned revenue to total expenditure (working expenses plus loan charges), and are taken from the Local Government Financial Statistics for 1943-44.

A difficulty arises over the working expenses of Trading Undertakings, as the Local Government Financial Statistics include "transfers to special funds and to capital accounts" with this item. The sums so transferred are much more nearly akin to the profits of a commercial undertaking than to working expenses so that in each case the amount of the latter is inflated beyond its true value. This means that the contrast between the 'trading' and

'rate fund' services is actually a little greater than it appears in this Table. Despite this difficulty the relation of total earned income to total expenditure is chosen as a basis for classification rather than the net burden on, or contribution to, the rate fund of the service. The size of the rate fund contribution to the service is certainly significant, but the amount of transfers in aid of rates does not give a fair picture of the profitability of undertakings because many authorities have adopted the practice of paying any surplus back into the undertaking (by amortisation of debt, purchase of capital equipment out of revenue, and accumulation of reserve funds) and no longer attempt to relieve the rates from trading surpluses. Any deficiency in the accounts of an undertaking (unless it is so small or unusual that it can be met from a reserve fund) will be reflected as a burden on the rate fund, but many surpluses will not be shown as a transfer in aid of rates. The amounts contained in the column headed "Income of service from Government grants" has not been included with earned revenue, although in some cases this might seem legitimate. The make-up of these government grants, according to the Ministry of Health is as follows - "A considerable proportion of the entries

represent grants in respect of employment schemes; in addition there are a number of reimbursements from Government Departments for a variety of purposes, such as payments from the Admiralty for the use of harbours and piers and from the Air Ministry for the use of airfields. Certain payments are made by the War Office in compensation for damage to properties requisitioned by the military authorities. A payment is made by the Ministry of Food in respect of British Restaurants and Communal feeding. In addition the figures include receipts for civil defence and war damage."[1]

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1. Communication from Ministry of Health, Statistical Branch, 16.2.49.

Table 38. Classification of local authority services on the basis of relation of expenditure to earned income.1

Service	Total expenditure £	Earned income £	Income as % of expendre. %	Govt. grants £	Rate burden £
	00.000's omitted			00.000's omitted	
1.Higher Education	31.1	5.6	1.789	12.6	13.0
2.Fire Service	6.9	.2	2.898	4.3	2.4
3.Police	36.1	1.1	3.047	20.6	14.4
4.Public Lighting	1.5	.07	4.666	.003	1.5
5.Elementary Education	89.2	4.9	5.492	43.7	10.6
6.Public Libraries	3.9	.3	7.691	.01	3.5
7.Highways and Bridges	38.9	3.1	7.97	5.3	30.5
8.Poor Relief	28.4	3.2	11.27	.1	25.0
9.Parks & Pleasure Grounds	6.6	1.4	21.21	.08	5.2
10.Baths,Washhouses	3.4	1.3	38.23	.04	2.0
11.Housing	41.8	25.2	60.29	12.6	4.1
12.Cemeteries	2.3	1.5	65.23	.005	.8
13.Water	27.2	26.2	96.32	.2	1.4
14.Miscellaneous	14.0	13.7	97.86	.2	.5
15.Transport	35.0	35.3	100.9	.01	.02
16.Electricity	81.4	82.4	101.2	.1	.2
17.Gas	28.1	28.5	101.4	.1	.06
18.Harbours	18.3	18.9	103.3	.3	.2

Note: (a) Figures to nearest 100,000

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1. Compiled from L.G.F.S. 1943-44.

The conclusion of this part of the investigation is, then, that the only distinction between 'trading' and the 'social' services of a local authority was to be found in their financial policy, where the management of the undertaking was governed by the guiding principle that it must be made financially self-supporting. Where the self-discipline of not relying on tax support was abandoned then the service was in fact indistinguishable from a social service. When this criterion is applied, however, it became apparent that the activities of local authorities could not be readily divided into distinct groups, those which were trading on one side and those which were 'social' on the other. The general picture was somewhat more complicated. Besides the small number of services which were wholly self-supporting and those which were almost entirely dependent on tax support, there were a number of intermediate services depending on rate-fund aid to a varying extent. One service, water supply, could be divided more or less on a geographic basis, being mainly a trading service in urban areas, and invariably a largely rate aided service in the country. Also there were what might be called sub-services connected with rate-fund services which were themselves of a trading or semi-trading nature. The two industries

with which this study is mainly concerned were (with Transport) the most clear examples of purely 'trading' services in which the social service principle of subsidisation, and all that that implies, had no real influence up to the time of nationalisation.

SECTION 2

THE GAS AND ELECTRICITY INDUSTRIES

CHAPTER I

Structure and problems of the gas industry before nationalisation

The main purpose of this section is to deal with the 'background' of the problems of the gas and electricity industries in such a manner as to prepare the way for the comparisons made in the next section. In this and the subsequent chapter the structure and main problems of the two industries are described. Special attention has been given to that difficulty which has been used as the main reason for altering the form of control of the two industries - the problem of areas.

A. Structure

The gas industry serves three principal markets directly - domestic cooking and heating; industrial; and street lighting. The industrial load may be subdivided into purely industrial (use in gas engines and for heating) and "commercial" (baking, fish frying, etc.). The latest returns of the Ministry of Fuel and Power divide gas sales between the categories - "Public Lamps"; "Domestic" (Ordinary and Prepayment), "Industrial", and

"Other". The amount of gas sold to these different classes of consumers in 1947 is shown in the following tables -

Table 39 Sales of Gas, all undertakings in England and Wales, 1947.[1]

Consumer	Sales, 1,000 cu.ft.
Public Lamps	4,493,549
Ordinary domestic	87,502,731
Prepayment domestic	170,606,654
Total domestic	258,109,385
Industrial	85,420,677
Other	50,233,824
TOTAL	398,257,425

Table 40 Sales of Gas, England and Wales, 1947 - All Local Authority Undertakings[2]

Consumer	Sales, 1,000 cu.ft.
Public Lamps	2,225,654
Ordinary domestic	25,199,433
Prepayment domestic	55,289,374
Total domestic	80,488,807
Industrial	34,256,968
Other	14,415,127
TOTAL	131,386,556

The domestic market is therefore much the most important for the industry. An estimate of the sales

1. Return relating to gas undertakings in G.B. 1947.- Ministry of Fuel and Power.
2. Ibid.

position before the war, made in the Heyworth Report, is as follows:-

Domestic load	65%	of total output.[1]
Industrial load	20%	
Commercial load	10%	
Street lighting load	5%	
	100%	

In some industrial districts these percentages are considerably altered. Estimates of pre-war industrial loads for three highly industrialised towns were - Sheffield 65%, Rotherham 62%, and Stretford 42% of total sales.[2] None of these markets represents an unchallenged monopoly for the gas industry. For domestic cooking and heating there is competition from electricity and solid fuel. Electricity and oil compete in many industrial and commercial uses, and electricity is a competitor for the public lighting load.

Gas can be stored, but only to a limited degree. Storage capacity is generally limited to about one day's supply.[3] Peak demand is influenced mainly by the domestic cooking load, which causes peaks daily at about midday,

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1. The Gas Industry - Report of "Heyworth" Committee, para. 107.
2. Chantler, The British Gas Industry.
3. Batson, Price Policies of German Public Utility Undertakings.

and a weekly peak on Sunday mornings and by the demand for space heating which causes a seasonal peak in mid-winter. It is this seasonal peak which ppovides the greatest problem for gas engineers. The daily peak can be met mainly from reserves of gas in gasometers; the weekly and yearly peaks necessitate the installation of surplus manufacturing capacity.

A special feature of the gas industry is the importance of the by-products of gas manufacture. The principal residue products are coke, coal tar, benzole and ammonia liquor (or ammonium sulphate where the undertaking made this itself). The sale of residuals forms a not inconsiderable part of the income of a gas undertaking. This may be illustrated from the accounts of a small local authority undertaking, with (in 1944) 11,110 consumers. This authority sold gas to the net value of £ 67,713 and residuals valued £ 41,013 in the year 1946/7. The residuals income was made up as follows (figures to nearest £):-[1]

	£
Tar	7,889
Coke	30,263
Benzole	2,740
Ammonia liquor	121
	£ 41,013

1. Borough of Darwen. Treasurer's Accounts, 1946-47. p.61.

Another local authority undertaking[1] with 5,750 consumers (in 1944) had an income from gas sales of £ 58,047, and from residuals of £ 31,369 in 1945/6. These figures, showing that, in these cases, the proceeds from sales of residuals were equal to approximately 60.6% and 54% respectively of the income from gas sales, make clear the importance of these by products. Municipal trading may thus be said to extend into the coke and chemical industries. The coke is sold mainly as fuel, - the coke produced in gas retorts is not suitable for blast furnace use. Some coke is used in the gasworks to make water and producer gas, which can be used to enrich the gas supply. The supply of coke on the market is made more elastic by this factor. A fall in the price of coke may make it profitable for an undertaking to divert more to the manufacture of water and producer gas. Coal tar is the basis of a considerable section of the chemical industry, - its derivatives including benzole; phenol and cresylic acid (used for making plastic material, aspirin, high explosives and dyes); toluene (used in the manufacture of the high explosive tri-nitrolnene, and of saccharin); cresote oil; naphtalene; anthracene oil (basis of a number of dyes); and coal-tar pitch. The larger gas undertakings carry out the distillation of at least some of these

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1. Malvern Urban District Council.

fractions themselves; the smaller works sell their coal--tar to coal-tar distillers. There are works for the distillation of coal-tar in all the larger industrial regions of Britan.[1] The Ammonia liquor is used to make ammonium sulphate, an important nitrogenous fertiliser.

Another feature of the industry is that there is more than one method of producing coal-gas. A considerable quantity of gas in produced as a by-product of coke ovens. At the time of the Heyworth Report (1945) about 12% of the total gas supply came from coke ovens.[2] In Great Britain in 1944 local authorities supplied just over one third of the total public supply of gas. All the companies together (including non-statutory undertakings), accounted for 63.2% of the total supply. Of the remaining 36.8% individual municipalities supplied 35.7% and local authorities combined in joint boards supplied 1.1%.[3] The figures for 1947 are shown in the following table:-

Table 41. Sales of Gas and number of consumers, England and Wales 1947[4]

Class of undertaking	Total sold therms	Number of consumers
Local authorities	605,242,506	3,237,530
Companies	1,278,504,896	6,995,529
TOTAL	1,883,747,402	10,233,059

1. Wilmore, Industrial Britain, p.187.
2. Heyworth Report, para. 76.
3. ibid., para. 57.
4. Min. F. & P. Ret. 1947.

Of the total 1,047 separate gas undertakings (including 367 very small non-statutory undertakings) existing in Britain in 1944, 275 were owned by local authorities of which 210 were in England and Wales.[1] The 1947 figures are shown in the following table:-

Table 42. Statutory Gas undertakings in England and Wales 1947[2]

	No.of undertakings (a)
Local authority	212
Company	402

(a) Note: Each undertaking is included, even where more than one is owned by the same authority - e.g., Batley and Birstall undertakings are counted as two, although they were both owned by Batley Corporation.

The average size of undertakings (to nearest 1,000) in 1947 was:-

Local authorities	=	2,855,000 therms sold[3]
Companies (Statutory)	=	3,180,000 " "
All authorities	=	3,068,000 " "

The municipal undertakings may be classified according to the type of local authority by which they were managed. In England and Wales, control of gas undertakings was

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1. Min. F.& P. Ret. 1938-44.
2. Ibid., 1947.
3. Ibid.

confined to county and non-county boroughs, urban and a very few rural district councils, and joint boards.

Table 43 Classification of Municipal Gas Undertakings 1944[1]

Type of local authority	No. of undertakings
County boroughs	39
Non-county boroughs	69
Urban district councils	94
Rural district councils	4
Joint boards	4
TOTAL	210

The following table shows the classification according to size and local government status.[2]

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1. Min. F.& P. Ret. 1944, and Municipal Year Book, 1948.

2. Compiled from Min. F.& P. Ret., 1944.

Table 44 Classification of Municipal Gas Undertakings by size and ownership

Gas available 1000 cu.ft.	Type of Local Authority					
	C.B.	Non-C.B.	U.D.C.	R.D.C.	J.B.	Tot.
over 10,000	1	-	-	-	-	1
8000 - 10,000	1	-	-	-	-	1
6000 - 8,000	-	-	-	-	-	-
4000 - 6,000	2	-	-	-	-	2
2000 - 4,000	7	-	-	-	1	8
1000 - 2000	15	2	-	-	2	19
800 - 1000	7	-	-	-	-	7
600 - 800	1	5	-	-	-	6
550 - 600	2	1	-	-	-	3
500 - 550	1	6	1	-	-	8
450 - 500	-	1	-	-	-	1
400 - 450	-	3	1	-	-	4
350 - 400	-	2	2	-	-	4
300 - 350	1	6	-	-	-	7
250 - 300	-	6	3	-	-	9
200 - 250	-	10	5	-	-	15
150 - 200	-	3	11	-	1	15
100 - 150	-	6	16	-	-	22
50 - 100	-	13	23	2	-	38
Under 50	1	5	32	2	-	40
TOTALS	39	69	94	4	4	210

Apart from the general increase in the population the main causes of the increase in the demand for gas during recent times have been the expansion of the domestic cooking load, and the increased use of gas in industry. From about the middle 1920's until the outbreak of war the increase in demand for gas was not, however, keeping pace with the increased number of consumers, i.e., the average consumption per consumer was falling. This was partly due to the increased efficiency of gas appliances and partly to the more successful competition of electricity.[1] The number of local authority undertakings did not increase very rapidly after 1900 there being a decline in their number after the peak year of 1930.

Table 45. Number of Municipal Gas Undertakings in Great Britain, 1897-1938[2]

Year	No. of Undertakings
1897	212
1902	256
1907	276
1912	306
1920	304
1925	316
1930	324
1935	309
1938	298

1. "Heyworth" Report, The Gas Industry, Cmd. 6699, 1945, paragraph 17.
2. Chantler, The British Gas Industry, p.7, and "Heyworth" Report, paragraph 15.

The number of company undertakings declined from 494 in 1920 to 405 in 1938.

Table 46 Sales of Gas and Total number of Consumers all statutory Gas undertakings 1897 - 1938 Great Britain.[1]

Year	Total Sales (Millions of therms)	No. of Consumers
1897	611	3,025,000
1902	739	4,071,000
1907	864	5,665,000
1912	995	6,876,000
1920	1,177	7,448,000
1925	1,329	8,200,000
1930	1,383	9,344,000
1935	1,405	10,517,000
1938	1,494	11,215,000

During the war years the demand for gas increased mainly because of the growing demands of war industries, which more than outweighed the disappearance of the public lighting load.

1. "Heyworth" Report, paragraphs 8 and 15.

Table 47 Sales of Gas, All Authorised Undertakings in Great Britain, 1938-44.[1]

Year	Sales Millions of Therms
1938	1,497
1939	1,487
1940	1,433
1941	1,513
1942	1,626
1943	1,656
1944	1,737

This expansion of demand, was not uniform throughout the country. In Greater London the expansion of industrial demand was insufficient to offset decreased lighting, domestic and commercial demand. The sales of gas declined from 485 million therms in 1938 to 444 million therms in 1944.[2] Examples of local authority undertakings with a considerably increased demand are shown in Table 48.

Table 48 Municipal gas undertakings with large increases in sales 1938-1944.[3]

Undertaking	Percentage increase of sales 1944 over 1938
Manchester	30
Stretford	41
Oldham	47
Wolverhampton(a)	71
Port Talbot	287

(a) = Company Undertaking

1. "Heyworth Report, para.25; Min.F.&P.Ret. 1938-1944.
2. Ibid., para 24 and Ministry of Fuel.
3. "Heyworth" Report, para. 27-9.

Apart from the increased demand for gas itself, the war expanded the demand for by products of the industry, particularly for benzole, coal tar and its derivatives, and for hydrogen for barrage balloons.[1]

Three factors made the expansion of supplies difficult - the shortage of coal, manpower difficulties, and war damage to plant. The coal shortage created difficulties for all the public utilities industries, with the exception of road passenger transport. The weekly average output of coal declined from 4,624 million tons in 1938 to 3,615 million tons at the end of 1945.[2] The gas industry had to compete with many others in its efforts to obtain coal. Between 1938 and 1944 the increases in the consumption of the main fuels used was as follows:- coal consumption increased from 16,734,169 to 18,037,836 tons; coke consumption from 510,032 to 1,073,836, and oil consumption from 31,631,339 to 86,746,013 gallons. (These figures are for England and Wales.[3] The manpower position affected all the public utility industries.

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1. "Heyworth" Report para. 27-9.

2. Economic Survey for 1947.

3. Min. of Fuel and Power Returns relating to all authorised gas undertakings in G.B. 1938-1944.

Table 49 Manpower in the gas, water and electricity industries. Gt. Britain, 1939 - 1946.[1]

YEAR	TOTAL MAN-POWER (a) thousands
1939 June	242
1945 June	196
1946 June	240
1947 June	266
1948 June	275

Notes: (a) = Males 14 - 64; females 14 - 59. Includes part-time workers, two being counted as one unit.
These figures do not include manpower engaged in local authority transport undertakings.

The war-time decline in man-power was thus more than made up by the end of 1947 when the process of demobilisation was virtually completed.

B. Variations in consumption level

The amount of gas consumed in relation to the number of consumers in different undertakings shows considerable variation. The modal annual consumption falls into the group 100-200 therms per consumer.

1. Economic Surveys for 1947 and 1948, Monthly Digest of Statistics, August 1948.

The range in 1947, was from less than 100 therms per head to over 300 therms.

Examples of undertakings at each end of the range were:-

Low	Swadlincote U.D.C.	= 60.3	therms per consumer
	Kirkby in Ashfield	= 56.9	"
High	Rotherham Corp.	= 386.8	"
	Swinton and Mexborough Joint Board	= 964.3	" [1]

There are a number of factors which might be expected to influence the level of total sales of gas per consumer. These are:-

1. Price of the gas.
2. Amount of industrial demand.
3. Sales to other undertakings in bulk.
4. Sales for public lighting.
5. Competition from electricity.
6. Development of domestic load.
7. Success of sales policy.

The relationship of price to sales of gas (i.e. elasticity of demand) is considered below.[2]

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1. Calculated from Min. F.& P. Ret. - 1947.
2. Cf. p. 115.

The amount of industrial demand is obviously likely to have a strong influence on the level of total sales per consumer since one industrial consumer will normally consume much more gas than the average domestic consumer. It seems likely that the existence of industrial demand is largely fortuitous, though in certain cases it may be built up by a progressive sales policy. The three factors - bulk sales to other undertakings, sales for public lighting and the degree of competition are also probably mainly determined by influences which are 'given' rather than determined by the independent decisions of the managements of gas undertakings. There does not appear to be any important reason why domestic demand should vary in 'intensity' except in so far as it is itself influenced by factors 1 and 7 in the above list - price and sales policy. A possible factor which may become of increased importabce with the present great preponderance of local authority building of dwelling houses is the influence of policy decisions on whether council houses shall be provided with gas or electric appliances. At the International Gas Conference held in London in June 1949 a report was given on an investigation into "Factors controlling the demand for gas", analysing the domestic load. This stated that given the size of the house and uniform equipment the demand for gas for the base load (cooking, water heating

and refrigeration) varies little with locality. Prices substantially above or below the average were shown to affect the quantity consumed however.[1] Sales policy may be expected to influence demand per consumer in three ways. Successful advertising and sales promotion may induce domestic and industrial consumers to use extra gas appliances. The provision of adequate maintenance service may have a similar effect. Thirdly the tariff adopted may influence sales - particularly such decisions as whether or not to offer a two-part tariff; whether to scale down prices for increased consumption; whether to offer special rates to industrial and commercial consumers; and how to relate the prices charged to ordinary and to pre-payment consumers.

In the following analysis an attempt is made to isolate some of the factors mentioned above and to examine their influence on sales per consumer and to relate this, where possible, to the form of ownership.

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1. Gas Times - 1st July, 1949, p.40.

Table 50 Size and Annual Sales per consumer of samples of gas undertakings.[1]

Sample	Annual sales per consumer, 1947. Therms			
	Average	Median	Highest	Lowest
Random sample of 33 undertakings	146.1	154.0	209.3	81.0
11 undertakings selling more than 10 million therms in 1947	221.9	177.6	177.6	138.4
11 medium undertakings selling 500,000 - 1,000,000 therms in 1947	150.7	152.1	223.1	99.2
All local authorities (England and Wales)	186.8	-	-	-
All companies (England and Wales)	182.9	-	-	-

This table indicates that there is some degree of correlation between size and 'intensity' of demand per consumer. Of the 7 factors mentioned above, the price, sales to other undertakings, efficiency of sales policy, and possibly degree of industrial demand, might be expected to cause the consumption per consumer to be higher in the larger undertakings.

The relationship between industrial demand and total sales per consumer is examined in Table 51.

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1. Compiled from Min. F.& P. Ret., 1947.

Table 51. Industrial Sales and Total Sales of Large Gas Undertakings - 1947[1]

Undertaking	Average sales per consumer Therms	Total Sales Million Therms	Industrial sales as % of total sales %	Av. Sales	Rank[a]
Leeds	138.4	21.9	19.8	1	4
Nottingham	151.0	21.2	14.8	2	2
Oldham	155.0	10.2	22.3	3	5
Leicester	156.2	16.4	17.2	4	3
Bradford	159.2	13.1	28.0	5	7
Manchester	177.6	38.9	23.8	6	6
Coventry	236.7	17.2	37.0	7	9
Middlesbrough	264.0	10.5	14.1	8	1
Birmingham	270.6	94.8	34.1	9	8
Stoke-on-Trent	345.3	24.2	55.9	10	10
Rotherham	386.8	10.2	57.4	11	11
Gas, Light and Coke Co.	185.8	266.1	14.6	1	1
Sheffield Gas Co.	314.9	61.8	67.3	2	2

(a) Note: Rank is in increasing order of average sales per consumer and of proportion of industrial sales to total sales.

1. Compiled from Min. F.& P. Ret., 1947.

Inside this group of large undertakings (all with sales of more than 10 million therms in 1947) there appears to be no clear relationship, in ranking, between the size of total sales and that of average sales per consumer corresponding to the correlation between large total and high average sales shown in the group averages in Table 51. This Table indicates, as would be expected, that the proportion of industrial sales to total sales has some influence on the level of total sales per consumer. In this series there is a clear tendency for the percentage of industrial sales to increase as average sales per consumer increases, though there are some exceptions to this - most notable being Middlesbrough. Using Professor Spearman's "Ranking" formula

$$p = \frac{6 \quad d^2}{n^3 - n}$$

$p = .673$

or,

removing Middlesbrough from the table,

$p = .915$

Calculation of the coefficient of correlation

$$xy = \frac{\frac{1}{n} (x - \bar{x}) (y - \bar{y})}{\frac{1}{n} (x - \bar{x})^2 \frac{1}{n} (y - \bar{y})^2}$$

between average sales per consumer, and industrial sales as a percentage of total sales gave the following result:-

$$+ xy = \frac{1152.874}{\overline{6397.822} \times \overline{303.758}}$$

$$= + \frac{1152.874}{1394.075994}$$

$$= + .8269807$$

This shows a fairly strong positive correlation.

The effect of industrial sales on total sales per head is particularly noticeable in some individual comparisons of undertakings of similar size, as shown in Table 52.

Table 52 — Industrial sales and average sales of individual Gas Undertakings[1]

Undertaking	No. of consumers	Total Sales Therms	Average sales per consumer Therms	Industrial sales as % of total sales %
Rotherham	30,930	11,961,760	386.8	57.4
Rochdale	31,071	4,523,609	145.6	23.2
Swinton	5,333	5,142,670	964.3	91.4
Wath	9,918	983,925	99.2	8.6

1. Compiled from Min. F.& P. Ret., 1947.

All four of the undertakings in the above area were supplying industrial areas - Wath and Swinton supply areas actually adjoining each other. This brings out the fact that it is only certain specialised industries which consume large quantities of gas - the chief being glass and pottery manufacture and some types of steel furnaces. Thus in Stone-on-Trent, a typical region of high demand, (345.3 therms per consumer in 1947) the consumption of the ceramics industry accounted for 2,593 million cu. ft. out of a total industrial demand of 2,856 million cu. ft. in 1947 (an increase from the 1932 figure of 8 million cu. ft.).[1] Similarly, in Rotherham the nature of the local industry had an important influence on demand for gas. The chief industries in Rotherham which accounted for the heavy industrial consumption of gas were "glass works, forge and rolling mills, and general heat treatment of metals".[2] In Swinton and Mexborough two very large industrial consumers - a glass works, and a steel works, consume 80% of the total output, thus accounting for the exceptionally high figure of sales per consumer.[3] In Smethwick the development of the industrial load was advanced in 1920

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1. Ibid., and Municipal Journal, 2.5.48.
2. Information obtained from the Sheffield and Rotherham Divisional Manager, East Midlands Gas Board, 23.11.50.
3. Ibid.

when an Aluminium Castings firm began to buy town gas for its reheating furnaces. Other industrial undertakings purchasing gas from Smethwick include a glass works (though this firm also made its own supply of producer gas) and hot brass stamping works.[1]

The following Table (53) is similar to Table 50, but the figures are for domestic sales only, so that the influence of sales for other purposes is eliminated.

Table 53 Size and annual domestic sales per consumer of samples of gas undertakings[2]

Group of undertakings	Annual domestic sales per consumer, 1947 (Therms)			
	Average	Median	Highest	Lowest
Random sample of 33 undertakings	104.3	107.2	134.7	49.8
11 undertakings selling more than 10 million therms in year	119.29	117.3	169.8	83.7
11 undertakings selling 500,000 - 1,000,000 therms in year	110.2	113.6	143.3	72.6
All municipal undertakings in England and Wales (Est.)(a)	11.9	-	-	-
All company undertakings in England and Wales (Est.)(a)	114.2	-	-	-

(a) Note: Estimated at a standard calorific value of 450.

1. Information obtained in an interview with Mr L.H.Thomas, Engineer and Manager, Smethwick District, West Midlands Gas Board, 8.12.50.
2. Calculated from Min. F.& P. Ret., 1947.

This shows that there is less variation in domestic sales than in total sales. This is as might be expected since industrial demand varies very much in different areas while domestic demand per head is relatively uniform throughout the country. As with total sales, though to a lesser degree, there is a tendency for average demand per consumer to increase with the size of the undertakings in the sample.

There are several interesting questions about the relationship between sales and the price of gas, but to pursue any of these very far would be to go beyond the scope of the present study. Without making a detailed historical investigation of each individual undertaking it is difficult to say whether low price encouraged a large industrial demand, or whether the existence of a high level of demand for gas from industry made a low price possible because of the economies of scale and the favourable effects on load factors. It is certainly not possible to isolate the effects of managerial decisions on the level of industrial demand from other influences such as the nature of the industry in the undertaking's supply area and the relative cost of alternative fuels. This is not, therefore, a matter in which the results of private and public ownership can be compared.

In the case of domestic demand a positive correlation

between low price and a high level of demand would be more meaningful since potential domestic demand is much more likely to be directly related to the population in the area than is industrial demand. Even here, however, the complicating factor of the price of alternative sources of heat and lighting (particularly electricity, of course,) exists. The following tables show the relationship between sales and domestic price only for small samples of undertakings.

Table 54 Domestic Price and Average Total Sales per Consumer for Large Gas Undertakings, 1947[1]

Undertaking	Rank by sales per consumer[a]	Average sales per consumer Therms	Price per therm. Domestic consumers d.per th.	Rank[a]
Leeds	11	138.4	10.25	5
Nottingham	9	155.0	11.625	7
Leicester	8	156.2	13.25	11
Bradford	7	159.2	12.5	8
Manchester	6	177.6	13.0	10
Coventry	5	236.7	12.875	9
Middlesbrough	4	264.0	5.25	1
Birmingham	3	270.6	10.625	6
Stoke-on-Trent	2	345.3	(3.625-) 7.625	3
Rotherham	1	386.8	10.0	4

(a) Note: Rank is by decreasing order of sales and price per therm.

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1. Compiled from Min. F.& P. Ret., 1947 and "Preston" Rate Return 1946-7.

There appears to be little connection in this sample between price and average sales per consumer, though the four undertakings having the largest sales per head do fall into the lower half of the price grouping. The position of Middlesbrough in the table may be specially influenced by the unusually low price (the lowest in the country for many years) as its sales of gas to industrial consumers were a comparatively small proportion of total sales.[1]

Table 55 Domestic Price and Average Domestic Sales per Consumer for Large Gas Undertakings[2]

Undertaking	Price - domestic consumers d. per therm	Average sales domestic consumers Therms	By price (Lowest = 1)	By sales per consumer (Highest = 1)
Middlesbrough	5.25	169.8	1	1
Nottingham	7.5	117.3	2	6
Stoke-on-Trent	7.625	127.3	3	4
Rotherham	10.0	126.4	4	5
Leeds	10.25	90.16	5	10
Birmingham	10.625	157.6	6	2
Oldham	11.625	90.7	7	9
Bradford	12.5	83.7	8	11
Coventry	12.875	137.0	9	3
Manchester	13.0	101.0	10	8
Leicester	13.25	11.2	11	7

1. Cf. 115.
2. Compiled from Min. F.& P. Ret., 1947 and Preston Rate Return 1946-7.

In this table the complicating factors of sales to other consumers, sales for public lighting, and sales to industrial and commercial consumers are eliminated by taking the figures for domestic consumption only. Nevertheless, there does not appear to be sufficient correlation between low price and high average sales per domestic consumer to establish any clear relationship between them. Using Professor Spearman's formula, $p = +.418$. Calculation of the coefficient of correlation between price and average sales gave a figure of -.55 showing a rather weak negative correlation.

Table 56 Domestic sales and price - random sample of gas undertakings, 1947[1]

Undertaking	Domestic sales per consumer Therms	Price d. per therm	Ranking By consumer	Ranking by price
Batley	49.8	15.0	1	3
Kendal	77.4	16.0	2	1
Beverley	78.5	14.625	3	4
Doncaster	87.8	9.125	4	14
Abertillery	91.3	15.75	5	2
Darwen	95.0	12.0	6	8
Alkeston	95.9	11.0	7	12 and 11
Heywood	98.0	12.25	8	7
Blackpool	98.8	11.125	9	10
Colne	110.2	11.5	10	9
Goole	116.3	10.625	11	13
Chelmsford	127.9	13.0	12	6
Burton	128.3	14.0	13	5
Birkenhead	132.0	11.0	14	12 and 11

1. Calculated from Min. F.& P. Ret. 1947.

This table shows some degree of correlation in ranking though the amount is relatively small. Using Professor Spearman's formula

$$p = +.4594$$

Calculation of the coefficient of correlation between price and average 'domestic' sales per consumer gave a figure of -.41 showing a weak negative correlation. Combining the figures of Tables and the coefficient of correlation was calculated to be - .57. Thus price does not appear to have had a marked effect on the level of domestic sales of gas. These figures cannot be used as direct indications of the elasticity of demand (from domestic consumers) for gas, since they measure demand in distinct markets in which the conditions of demand may have been different, rather than the effects of price changes in the same market. Nevertheless, since variations in the conditions of demand from domestic consumers in different areas would be unlikely to be sufficiently great to cancel out the effects of price differences if demand was elastic, these figures can be said to point to the conclusion that the 'domestic' demand for gas was inelastic over the price range covered.

C. Coke-Oven Gas

Some special attention was given to the use by gas undertakings of supplies of cake-oven gas. In particular, the effect of the use of this alternative source of supply on costs and price was considered.

The primary product of coke ovens is metallurgical coke, used chiefly for the smelting of iron-ore in blast furnaces. As far as efficiency in manufacturing gas is concerned there is no significant difference between coke ovens and vertical retorts. The factor which has led gas undertakings to use retorts almost exclusively in their own works is that there is always a local market from domestic consumers and some industrial consumers for the coke which they produce, whereas the demand for hard metallurgical coke is very localised. Coke-oven gas is also of a high calorific value (about 550) and this must be reduced to the values generally adopted today before distribution. This can be done either by recovering the benzole from the gas or by mixing it with water gas. Birmingham gas undertaking did operate a coke-oven plant from 1912 until the years of the depression, when it was closed down. A large coke-oven plant intended for the production of town gas has recently been opened. The Map C shows the location of undertakings consuming coke-

oven gas.[1]

Local authorities have often entered into contracts with coke-oven owners for the supply of gas to supplement or replace that from their own gas works. Some local authority gas undertakings have in this way come to do little more than distribute gas manufactured by a colliery or iron company. Thus in 1944 Middlesbrough Corporation had 1,854,181,000 cu. ft. of gas available, but it made none of this itself, purchasing 3,037.000 cu. ft. from another gas undertaking and 1,851,144,000 from the coke--ovens of Messrs. Dorman Long and Company.[2] The purchase of coke-oven gas has, in the past, had one great advantage: the price charged by coke-oven owners (to whom the gas might otherwise be a waste product) has usually been low. Among the undertakings charging the lowest prices to the public for gas supplied, those purchasing coke-oven gas figure prominently. But there are also disadvantages. The undertaking has no control over manufacture and the supply available may not be sufficiently flexible for the needs of a distributing undertaking. A gas works may have to be kept in order as a standby or to meet peak demand. The supply is also uncertain. When a contract expires, the coke-oven operators might cut off supplies while

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1. Cf. Map B.
2. Ministry of Fuel and Power ret. 1944.

bargaining for a higher place, or might decide to use more of the gas manufactured in its own works. If the demand for pig iron and consequently for metallurgical coke declines the company may wish to reduce production in its coke-ovens. All these contingencies could lead to serious difficulties for a gas undertaking with a statutory duty to give a supply of gas to consumers. The exact relationship between the proposed Gas Area Boards, the National Coal Board, controlling the coke-ovens formerly operated by colliery companies, and the iron and steel industry's coke-ovens (whether controlled by companies or a national board), promises to be one of the knottier problems of nationalisation.[1]

The possible disadvantage of using coke-oven gas, which relate mostly to fears about the future, have not prevented the quantity of coke-oven gas bought by gas undertakings from expanding steadily during recent years.

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1. See, for example, "Controversy about Coke", The Economist, Dec. 15, 1951, pp. 1481-2.

Table 57 Purchase of coke-oven gas by statutory gas undertakings in Great Britain[1]

Year	No. of purchasing undertakings	Quantity of coke-oven gas bought. 1,000 cu. ft.
1921	14	1,325,027
1926	22	2,321,850
1931	31	13,923,456
1936	40	24,329,216
1937	45	28,028,288
1938	45	29,620,854
1939	49	33,010,050
1940	51	36,882,944
1941	53	40,647,621
1942	52	45,693,357
1943	52	47,594,550
1944	52	49,318,916
1945	52	51,476,308
1946	52	52,924,256
1947	52	53,772,247

Of the 52 undertakings purchasing gas from coke-ovens in 1944, 21 were municipally owned. Included in this number were two joint boards (Accrington District and Swinton and Mexborough). As might be expected all the undertakings concerned were located on coalfields or in iron and steel manufacturing districts. Five were in the West Riding, three in Nottingham and in South Wales, two each in Lancashire, Staffordshire, and the North

1. Min. F.& P. Ret., 1944 and 1947.

Riding, and one each in Derbyshire, Co. Durham, Lincolnshire and Cumberland.[1]

Table 58 Municipal undertakings purchasing coke-oven gas, England and Wales, 1944[2]

Authority	Total gas available 1000 cu.ft.	Coke-oven gas purchased 1000 cu.ft.	% of total represented by coke-oven gas
1. Pontypridd U.D.C.	403.735	403,735	100.0
2. Rawmarsh UDC	98,813	98,813	100.0
3. Sutton-in-Ashfield UDC	189,916	189,916	100.0
4. Swinton and Mexborough JB	1,026,131	1,026,131	100.0
5. Wombwell UDC	141,554	141,554	100.0
6. Workington MB	345,193	345,193	100.0
6. Redcar MB	299,744	293,012	97.7
8. Middlesbrough CB	1,854,181	1,851,144	95.3
9. Rhondda UDC	350,238	332,376	94.9
10. Darlington CB	1,127,475	1,053,043	93.4
11. Accrington JB	1,003,454	807,735	80.4
12. Mansfield MB	525,973	405,100	77.0
13. Port Talbot MB	677,096	494,337	73.0
14. Ossett MB	233,678	169,027	72.3
15. Newcastle-under-Lyme MB	507,481	351,013	69.2
16. Rotherham CB	2,259,133	1,507,656	66.7
17. Chesterfield MB	1,455,886	948,653	65.2
18. Stoke-on-Trent CB	3,739,263	1,974,595	52.8
19. Scunthorpe MB	206,188	97,314	47.2
20. Burnley CB	1,093,553	503,549	46.0
21. Nottingham CB	4,115,382	1,308,285	31.8

[Abbreviations: UDC Urban District Council. MB- Non-County Borough. JB-Joint Board. CB- County Borough.

1. Cf. Map 3. 2. Compiled from Min.F.& P. Ret., 1944.

It appears that gas undertakings which do purchase coke-oven gas at all come to rely on it as their main source of supply. For 14 of the 21 local authority undertakings taking any coke-oven gas in 1944, it constituted over 70% of their total supply.

The coke-ovens supplying coke-oven gas were owned, before 1947, by chemical companies, collieries, and iron and steel companies. Of a sample of 12 undertakings taking coke-oven gas, in 1948, three of the coke-ovens were owned by chemical and coke-oven companies, six by the National Coal Board, as successors to colliery companies, and four by iron and steel companies. (One undertaking purchased supplies from two distinct coke-oven owning companies.)

Coke-oven gas is bought by contract, and the terms of these contracts seem to vary considerably. The prices charged to eight undertakings which answered a questionnaire on this subject were as follows:- (pence per 1000 cu.ft.) 7; 8,75; 9,875 (crude gas) and 10,375 (domestic and ordinary); 10 and 19.5 (on supplemental agreement); 13.0; 14.75; 19.0; 21.0. Most of the contracts contain a "coal clause" providing for a variation in the price charged according to the price of coal. Two examples were as follows: a variation of 1/8d. for every 6d. variation in general price of coal; 1/4d. per 1000 cu.ft.

variation for every 1s. 0d. per ton rise or fall in the price of coal. Of eight contracts on which information was available, the periods left to run varied from five months to seventeen years. This information is shown in tabular form below. (An undertaking was given not to disclose details of the contract of any individual undertaking.)

Table 59 Individual coke-oven gas contracts[1]

Undertaking	Price of gas d./1000cu.ft.	Source from which obtained	Period for which agreement remained in force.
A	7.0	National Coal Bd.	4 years
B	8.75	National Coal Bd.	5 months
C	9.875) 10.375	National Coal Bd.	17 years
D	10.0) 19.5)	Coke & Iron Co.	11 years
E	13.0	Chemical Co.	-
F	14.75	National Coal Bd.	7 years
G	19.0	National Coal Bd.	10 years
H	21.0	National Coal Bd.	3 years
I	-	Coke Co.	4 years
J	-	Coke Co.) Ironworks)	-
K.	-	Iron & Steel Co.	-
L	-	Iron & Steel Co.	-

The following discussion deals with the relationship between the prices charged by undertaking purchasing coke-oven gas and those manufacturing (or purchasing)

1. Information, from Questionnaire, relates to October, 1948.

gas made in retorts. It is assumed that these prices can be taken as a guide to production costs. Table 60 shows a comparison between two large samples of all types of undertakings, and a sample of undertakings purchasing coke-oven gas.

Table 60 — Average prices charged to domestic consumers by a sample of undertakings purchasing coke-oven gas compared with two general samples, 1946-7[1]

Nature of sample	Average domestic price d. per therm
25 company and municipal undertakings purchasing coke-oven gas	9.72
291 company and municipal undertakings	12.51
75 company and municipal undertakings centred on County Borough areas	11.39

The 25 undertakings in the sample of those purchasing coke-oven gas (out of 50 undertakings making such purchases in 1947) all bought more than 50% of the gas which they had available for distribution except 3, - Burnley (35.5%), Nottingham (38.15%) and Sunderland (40.6%). The other

1. Rates levied in various towns, 1946-7, and Min. of Fuel and Power Return, 1947.

X.

samples, based on undertakings included in the "Preston Rate Return", include some 'coke-oven gas purchasing undertakings' amongst the majority of undertakings making retort gas. The 'coke-oven gas purchasing undertakings' sample has a considerably lower price average than either of the other two groups. This bears out the conclusion that undertakings buying coke-oven gas have usually had a cost advantage over those having to make their own supplies of gas. There is no reason to suppose that the 'coke-oven gas purchasing' undertakings included in the sample (comprising 11 undertakings centred on County Boroughs, 10 on non-county Municipal Boroughs, and 4 on Urban Districts) had any special advantage on account of size or low distribution costs. The 'coke-oven gas purchasing group' were able to sell at an average price of 1.67 d per therm less than that of the sample drawn exclusively from undertakings based on County Boroughs, which are generally the most favourably placed in regard to size and distribution costs. The following table (61) shows a comparison between three further samples, this time only municipal undertakings being included.

Table 61 Comparison of prices charged to domestic consumers by samples of municipal gas undertakings purchasing coke-oven gas with those supplying only retort gas. 1948[1]

Sample	Average domestic price d. per therm
12 undertakings buying coke-oven gas	10.56
4 Urban Districts and 5 Municipal Borough undertakings supplying only retort gas	12.71
9 County Borough undertakings supplying only retort gas	11.36

The two samples of 'retort gas undertakings' were all of local authorities situated on, or close to, coal fields. This selection was made in order to test the possibility that the cost advantage of 'coke-oven gas purchasing undertakings' might be no more than equivalent to the advantage possessed by all undertakings situated on coalfields, and thus having lower transport costs on their chief raw material. (All 'coke-oven gas purchasing undertakings' are situated on coalfields or near iron and steel works.) The evidence of the table shows that 'coke-oven gas purchasing undertakings' can sell more cheaply even than undertakings favourably situated on a coalfield. (The prices in this table cannot be compared

1. Various gas tariffs for July 1948.

with those shown in the previous table, as they relate to a later period, when general price increases had taken place in the industry.) Undertakings purchasing coke-oven gas have, it would appear, generally been able to purchase and distribute these supplies at a lower price than they would have had to charge had they manufactured the gas themselves.

D. The Areas Problem

One of the chief problems affecting both the gas and electricity industries before nationalisation was the increasing difficulty of reconciling the optimum technical size of undertakings with the territorial restrictions imposed by the pattern of municipal and company ownership existing in the industries. Although the problem was much more acute with electricity generation and distribution it was certainly not unimportant in the gas industry.

The areas problem is a result of twentieth century technique in supplying the public utility services, and the haphazard, unplanned growth of urbanism in Britain, with its accompanying unrealistic local government boundaries. The development of this problem first seems

to have been noted by some of the critics of municipal trading in that period at the beginning of the present century when local authority trading became a matter of keen controversy. The enemies of municipal trading were the first to see its possible weaknesses. Giving evidence before the Committee on Municipal Trading of 1900-03, Mr Morse, Chairman of the Municipal Trading Committee of the London Chamber of Commerce pointed out the difficulty of restricting municipal trading to a given geographic area.[1] Mr Emil Garcke gave a practical example of the results of divided local authority control over transport - on a tramway route, run by a company in the Midlands with which he was connected, and passing through the areas of four local authorities, each authority required a different type of tramcar. The matter could only be settled by the arbitration of the Board of Trade.[2] Sir B. Browne, a Company Chairman, stated that municipalities could not amalgamate, and that to have a number of small towns controlling trading undertakings was "going against the tendency of the age". The natural course was for such undertakings to be run by one company, which was not tied down by fixed boundaries, he argued.[3]

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1. Joint Select Committee on Municipal Trading, 1900-03, Q. 901.
2. Ibid., Q. 1191.
3. Ibid., Q. 1351.

It is possible to distinguish two aspects of the areas problem in the industries with which we are concerned. There is the need to have a supply area with a demand sufficient to absorb all the output of a plant of optimum size, and there is the desirability of a supply system rationally planned in relation to local geography and population distribution. It is in the first respect that the gas industry was generally in a less difficult position than was electricity supply. This was because efficiency does not increase with size in gas manufacture to the same extent as it does with electricity generation, and because, even where a gas works was below optimum size it was not always possible to do anything about this because gas could not readily be distributed from one works over a large distance as could electricity.

The cost of distributing gas is too high to make a gas grid, comparable to the electricity grid, practicable. It may be economically desirable for a small country town to manufacture its own gas, whereas it would not be desirable for the same town to generate its own electric current. There were no developments in the gas industry between 1900 and 1939 comparable to the setting up of the Central Electricity Board or the London Transport Passenger Board. It was in the conurbations, where districts which are geographically merely part of a larger

town are often independent local government units, that municipal boundaries were most inappropriate as a basis for gas supplies.[1] In London, the largest conurbation of all, large company undertakings already divided the area of supply betweem them.[2] The only general legislation relating to the areas problem in this period was that (dealing with the bulk supply of gas) the Gas Regulation Act, 1920,[3] made it possible for local authority (and company) undertakings to buy and sell gas in bulk on receiving a Special Order from the Board of Trade. Apart from this provision municipal undertakings could only deal with boundary problems by obtaining private Acts. The Gas Undertakings Act of 1934[4] enabled adjoining gas undertakings to give and take bulk supplies of gas without further formality.

The figures of municipal undertakings in 1938 show that the main changes between then and 1944 were in the disappearance of some of the smaller undertakings.

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1. Cf. pp. 368 - 372.
2. Cf. Map A.
3. 10 and 11 Geo. 5, c. 28.
4. 24 and 25 Geo. 5, c. 28.

Table 62 Changes in numbers of Municipal Gas Undertakings 1938-44.

Type of local authority	No. of undertakings in 1938	Decrease by 1944[1]
County boroughs	39	Nil
Non county boroughs	73	4
Urban district councils	102	8
Rural district councils	8	4
Joint Boards	5	1
TOTAL	227	17

Thus, while the number of county borough undertakings remained unaltered during this period, the number of rural district councils declined by as much as 50%. Without exception, the municipal undertakings which ceased to operate between 1938 and 1944 were small or of medium size.

1. Compiled from Board of Trade Returns 1938, and Ministry of Fuel and Power Returns, 1938-44.

Table 63 Size of Municipal Gas Undertakings absorbed or closed down - 1938-44[1] Figures relate to 1938.

Undertaking	Total sales 1000 cu. ft.	No. of consumers
Biddulph U.D.C.	16,769	1,507
Calne M.B.	30,057	1,357
Cheadle R.D.C.	10,372	695
Chorley R.D.C.	a	a
Coalville U.D.C.	60,458	3,850
Denton U.D.C.	a	5,186
Dukinfield M.B.	a	5,468
Eye M.B.	2,237	164
Fishguard & Goodwick U.D.C.	3,051	298
Glastonbury M.B.	54,188	2,837
Holmfirth U.D.C.	25,194	1,940
Horsham R.D.C.	5,083	316
Morley M.B.	110,186	8,426
Newcastle R.D.C.	5,040	1,562
Radcliffe J.B.	a	17,850
Thurstonland & Farnley U.D.C.	1,191[b]	160[b]
Tow Law U.D.C.	4,480	460

Notes:
(a) Figures not included, or relate only to part of the year, in 1938 returns.
(b) These figures are also included in those for Holmfirth U.D.C., which absorbed Thurstonland, before itself being absorbed by Huddersfield.

1. Ministry of Fuel and Power Returns, 1938-44.

The only undertakings which approached even medium size were those of the Radcliffe and Little Lever Joint Gas Board, and of Morley Corporation. Of the 17 undertakings concerned 12 were absorbed by a company undertakings (Biddulph, Calne, Cheadle, Chorley, Denton, Dukinfield, Fishguard and Goodwick, Glastonbury, Horsham, Morley, Newcastle-under-Lyme, and Radcliffe and Little Lever); three by another local authority (Coalville, Holmfirth and Thurstonland and Farnley Tyas); and two were closed down (Eye and Tow Law). On the whole gas companies seem to have been more vigorous in absorbing or combining with niehgbouring undertakings than do local authorities. In the case of the three undertakings absorbed by local authorities a small undertaking was adjacent to a large local authority undertaking, which was the obvious candidate to absorb it in any rationalisation scheme. Judging from a map of supply areas, however, Chorley, Biddulph, Denton, Dukinfield, Newcastle-under-Lyme, and Radcliffe undertakings could equally well have amalgamated with other adjacent local authority undertakings.

Some of the changes recorded were merely of ownership, and did not represent a movement towards larger supply units. The only clear cases of the absorption of small undertakings by larger ones were the absorbtion of Biddulph by the Kidsgrove Gaslight Co., of Newcastle-

-under-Lyne R.D.C., also by Kidsgrove, of Coalville by Leicester Corporation, of Holmfirth and Thurstonland by Huddersfield Corporation and of Calne by the Bath Gas Co. Morley, Fishguard and Glastonbury undertakings were turned into companies supplying the same area, and Horsham R.D.C. undertaking was sold to the British Gas Light Co., a holding company without any other works in the same area (its undertakings were scattered about the country at Holywell, Norwich, Ruthin, Trowbridge and Hull). At this rate of progress the formation of more rational supply areas in the whole country would have taken very many years to complete. The rate of amalgamation was somewhat more rapid in the years preceding the outbreak of war. Between 1931 and 1938 125 undertakings were amalgamated or merged in Great Britain. (This figure includes mergers between company undertakings.[1]) Many of these amalgamations were, however, merely an extension of the interests of a holding company, and did not necessarily involve physical integration. 21 mergers were carried out between 1939 and 1944, including company mergers, suggesting that the rate of amalgamation was slowed down by the war.

The rigidity of gas supply areas has, to some extent,

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1. The Gas Industry - Publication of the British Gas Council (1938; p.15, para. 38.

been reduced by the giving and taking of supplies of gas in bulk.[1] In 1944 84 company and 49 local authority undertakings in England and Wales sold a total of 9,388,573 thousand cubic feet of gas in bulk.[2] In the same year 49 local authority and 110 company undertakings purchased 9,606,445 thousand cubic feet. (The discrepancy between these figures may, presumably, be explained because (a) the returns of sales includes sales made to non-statutory undertakers; (b) the returns of purchases include gas bought from sources other than authorised gas undertakings or coke-oven owners, e.g., non-statutory gas companies; railway companies.)[3] By giving bulk supplies to other undertakings some local authorities have built up large "spheres of influence" outside their own statutory area of supply. In 1947 Birmingham supplied gas in bulk to Smethwick, West Bromwich, Oldbury, Dudley and Bromsgrove.[4] Coventry supplied in bulk to Birmingham[5] and to Nuneaton[6] in 1947. Besides supplying in bulk a number of the larger local authority undertakings supply

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1. Cf. pp. 365.
2. From Ministry of Fuel and Power Returns 1938-44.
3. Ibid.
4. Municipal Review, March 1947, p.96.
5. Ibid.
6. Ibid., September 1947, p.318.

direct to consumers in areas outside their municipal boundaries. Thus Birmingham supplies to Sutton Coldfield, Wednesbury, Darlaston and Coleshill consumers direct.[1] Similarly among other examples, Nottingham, Leicester, Manchester, and Salford (supplying Eccles) distribute gas directly outside their civic areas.

Some neighbouring gas undertakings not only give and take bulk supplies, but have made more definite joint working arrangements. St. Helen's is the centre of one such arrangement made by 13 local authority and 2 company undertakings.[2] During the recent war such inter-working was encouraged by the government. Under government auspices a war-time gas supply 'pool' was formed covering a considerable area of Derbyshire and Nottinghamshire. Undertakings included were those of Chesterfield, Derby, Nottingham, Mansfield and Clay Cross, some smaller gas undertakings, and all coke-oven plants in the area having a surplus of gas for sale. The main purpose of this scheme was to ensure adequate gas supplies to war factories in the district.[3] In 1948 the Working Party which was appointed to consider the setting up of a gas grid in

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1. Municipal Year Book, 1948
2. Municipal Review, May 1946, p.146.
3. Ibid., October 1946.

South Wales, supplied by coke-oven gas, reported in favour of this project. It recommended that the following undertakings should be included in the area of supply - Garw and Ogmore, Bridgend, Portcawl, Glyncorrwg, Llynni Valley (Maesteg): Neath, Tawe Valley, Swansea, Pontardulais, Ammanford, Gowerton and Llanelly.

CHAPTER II

Structure and problems of the electricity supply industry before nationalisation

Perhaps the outstanding characteristic of the electricity industry is that electric current cannot, economically, be stored. The load factor, the relationship of peak demand to average demand is therefore one of the main problems of the industry. This problem has been of considerable importance in influencing the growth of the industry.

Electricity is generated in steam stations, oil engine stations, gas engine stations, waste heat and refuse destructor stations, and by water power. The figures for these different sources of current are shown in the following table (64).

Table 64 Generation of Electricity, 1947[1]

Type of station	Units generated	% of total
Steam	38,934,340,972	96.92
Oil Engine	69,147,175	0.17
Gas Engine	1,034,075	-
Waste heat or Refuse destructor	41,429,404	0.10
Water Power	1,126,201,704	2.81
TOTALS	40,172,153,330	100.0

(This table related to authorised undertakings only.)

Steam stations, using coal, coke or oil for heating the boilers, are thus of overwhelming importance in this country. Only in the North of Scotland and South Scotland regions is more current generated by water power than in steam stations.[2]

The actual quantities of fuel used in 1942-3 were:-

Coal and coke = 20,866,003 tons

Oil fuel = 12,012 tons

Gas = 1825.8 million cu.ft.[3]

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1. Electricity Commission Return - Generation of Electricity in G.B., year ending 31st December, 1947.

2. Ibid.

3. Electricity Commission - Return of Engineering and Financial Statistics relating to Aythorised Undertakings in G.B. 1938-9 - 1942-3.

In the markets which it serves electricity differs from gas in that the industrial demand is greater than that from domestic consumers. The following table (65) shows the relative importance of the different markets for electricity in the four years 1920, 1938, 1944 and 1947.

Table 65 Electricity Sales by Class of Consumer.[1]

Year	Domestic and farm	Commercial	Industrial	Public lighting	Traction	TOTALS
			Million KWh			
1920	297	398	2,545	48	419	3,707
1938	5,361	3,107	10,320	367	1,249	20,404
1944	7,835	3,510	19,976	29	1,169	32,519
1947	12,728	3,973	17,606	190	1,361	35,858

This table indicates that the change over from a war to a peace time economy between 1944 and 1947 was accompanied by a fall in the total industrial demand and a considerable increase in the domestic demand.

The total number of authorised electricity undertakings in England and Wales in 1948 (at the vesting date for nationalisation, 1st April) was 506.[2] Of this number

1. Compiled from Min. of Fuel and Power Statistical Digest 1948-9, Table 101.
2. 23rd Report of Elec. Commissioners, 1947-8, p.17.

280 were only distributors of current, while 226 also generated some current themselves.[1] The number of generating stations in 1947 was 286 in England and Wales (and 48 in Scotland).[2] There was a very considerable range in the size of generating stations in 1947, as is shown in Table 66.

Table 66 Size of Generating Stations, G.B., 1947[3]

Size (Units generated) Units	No.	Percent of total %	Percent of total current generated %
Under 50,000	6	6.6	--
50,000 but under 100,000	22	4.2	--
100,000 " " 250,000	14	8.4	.01
250,000 " " 500,000	28	4.2	.01
500,000 " " 1,000,000	14	7.2	.04
1,000,000 " " 2,500,000	24	5.7	.07
2,500,000 " " 5,000,000	19	8.0	.23
3,000,000 " " 10,000,000	27	7.8	.44
10,000,000 " " 25,000,000	26	9.6	1.31
25,000,000 " " 50,000,000	32	8.4	2.56
50,000,000 " " 100,000,000	28	3.6	2.11
100,000,000 " " 200,000,000	12	7.2	8.43
200,000,000 " " 500,000,000	24	10.7	27.02
500,000,000 " 1,000,000,000	36	6.6	33.93
1000,000,000 and over	22	1.8	23.84
TOTALS	334	100.0	100.00

1. Calculated from E.C. - Gen. Elec. 1947.
2. Ibid.
3. 23rd Report of El.Com., p.19.

80.9% of the generating stations thus fell into the class generating less than 20^{0},000,000 units in 1947, but these produced only 15,21% of the total amount of current generated. 84.79% of the current available in 1947 was produced by the 19.1% of stations in the three largest groups - of more than 200,000,000 units output. The range from the smallest to the largest stations was considerably greater than amongst gas undertakings. The smallest gas undertakings produced less than 500,000 therms in 1947 but there was only one undertaking with an output of more than 100,000,000 therms.[1] These figures refer to the output of gas undertakings while those for electricity relate to that of individual generating stations. The range of size of gas works would therefore be considerably smaller than the figures for undertakings given above since the larger undertakings owned a number of plants. These figures reflect the facts that economies of scale continue to a larger size in the electricity industry than in the gas industry and that electric current can be transported much further, economically, than gas.

The following table (67) shows the changes in the number of stations falling into different size groups, since 1924.

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1. Cf. p. 105.

Table 67 Number and Size of Generating Stations, G.B., 1924-48[1]

Year	Size of Station				Total	Total Units
	Under 5000 KW	5,000-25,000KW	25,000-50,000KW	Over 50,000KW		Million KWh
1924	335	117	29	13	494	6,022
1926	307	118	36	21	482	6,992
1934	227	92	54	48	421	15,587
1944	166	82	35	79	362	38,245
1947	156	78	28	86	348	42,698
1948	149	75	28	87	339	46,493

This table shows very clearly the results of the policy of concentrating generation in the larger stations which has been followed since 1919. The number of stations in the two smaller groups (less than 25,000 KW) has decreased steadily since 1926. The number of stations of intermediate size (25,000 - 50,000 KW) was still increasing in 1934, but has since declined considerably. The number of stations in the largest group has increased continuously during the whole of the period. The total number of stations has decreased from 494 to 339 while output has increased from 6 to 46 million units.

1. Min. of Fuel and Power Statistical Digest, 1948-9.

Of the total units generated (by authorised undertakings) in Great Britain in 1947 (42,579,578,629), 18,104,826,246 were produced by Company undertakings and 24,474,752,383 by Public Authority Undertakers.[1] The 506 Authorised undertakings existing in England and Wales in 1948 were made up as follows:-

Companies	168[2]
Public Authorities	
Joint Electricity Authorities	3
Joint Boards of Local Authorities	5
Local Authorities	330
	506

The Companies had a relatively larger share of the generation of current than of its distribution. In Great Britain in 1947, 140 generating stations were owned by Companies, and 194 by Public Authorities.[3]

The total number of undertakings generating current in England and Wales was 226, of which 73 were Companies and 153 Public Authorities. The Public Authorities concerned were as follows:-

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1. 23rd Report of El. Com., p.18.
2. Ibid., p.17.
3. Ibid., p.18.

Local Authorities	147[1]
Joint Boards of Local Authorities	3
Joint Electricity Authorities	3

The Local Authorities owning generating plant were classified as follows, in 1947:-

County Boroughs	66[2]
Non-County Boroughs and Metropolitan Boroughs	64
Urban District Councils	17
	147

The costs of producing electricity may be divided into - cost of generation; cost of administration; administration and rates; and loan charges. The costs of one undertaking per unit sold in 1946 and 1947 are analysed in Table 68.

Table 68 Analysis of costs of Walsall Electricity Undertaking[3]

Expenditure	1946-1947 d.	1945-1946 d.
Energy purchased	.671	.696
Distribution	.066	.052
management and establishment	.076	.075
Rates	.037	.041
Total Revenue expenditure	.850	.864
Loan charges	.083	.112
	.933	.976

1. Compiled from E.C.Gen.Elec. 1947.
2. Ibid.
3. Report to County Borough of Walsall Electricity Supply Committee, October 1947.

(The Income Tax for 1946-7 - .015d. is omitted from above figures.)

Combining Rates with Management and Establishment, these figures may be expressed as percentages of the total cost, as follows:-

	%
Electricity purchased (=cost of generation)	71.9
Distribution	7.1
Management, Establishment and Rates	12.1
Loan charges	8.9

Comparable figures for a smaller undertaking in 1946-7 were:-

	%
Generation	.9229[1]
Distribution	.1373
Administration, etc.	.2171
Loan charges	.1667
Total	1.4440
Income Tax	.0389
Total	1.4829

Expressed as percentages (omitting Income Tax), these figures were:-

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1. Borough of Darwen, Treasurer's Account, 1946-7.

Generation	63.9
Distribution	9.5
Administration, etc.	15.0
Loan charges	11.6
	100.0

There has been little increase in the number of local authorities with powers to supply electricity since 1900, though the number of authorities which have made use of their powers has grown considerably. Thus in 1900, of 366 local authorities in Great Britain holding Provisional Orders, nearly two-thirds had not then begun to supply.[1] In 1938-9 local authorities (and five joint boards) were authorised to supply and only three were not exercising their powers.[2] The expansion in the sales of electricity has been much more spectacular than the growth of the demand for gas and water.

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1. Ballin, Organisation of Electricity Supply in Great Britain, p.44.

2. Return of Engineering and Financial Statistics, relating to Authorised Undertakings in Gr. Britain for the five years 1938-9 to 1942-43. Electricity Commission. Table 1.

Table 69 Units sold by Municipal Electricity Undertakings 1900-39 (a)[1]

Year	Sales of Electricity Units
1900-01	68,000,000
1910-11	639,000,000
1921-22	2,023,658,696
1925-26	3,609,731,268
1930-31	5,594,326,492
1931-32	5,963,913,696
1932-33	6,508,833,698
1933-34	7,304,747,183
1934-35	8,304,747,183
1938-39	15,232,471,000

Note: (a) Figures are for Great Britain and include joint boards.

1. Compiled from Finer, Municipal Trading, p.585, P.E.P. Report on supply of Electricity in G.B. p.133, and Table 12 (1938-9-42-3). E.C. - R.E.F.S.

Table 70 Units generated, and total number of consumers all authorised Undertakings in Great Britain[1]

Year	Units generated	No. of Consumers
1925-26	7,090,760,000	2,007,604
1926-27	7,804,480,000	2,297,199
1927-28	8,128,350,000	2,599,617
1928-29	9,500,600,000	2,993,939
1929-30	10,377,110,000	3,471,607
1930-31	11,436,600,000(a)	4,014,895
1931-32	12,144,910,000(a)	4,646,509
1932-33	13,037,810,000(a)	5,336,847
1933-34	14,370,940,000(a)	6,109,595
1934-35	16,138,400,000(a)	6,952,714
1938-39	24,809,652,000	10,113,452

Note: (a) Figures relate to calendar years 1930, 31, 32,33,34 respectively
All figures except for 1938-39 refer to steam generating stations only.

The main causes of the expansion of electricity sales (apart from the growth of the population) have been the taking over of markets formerly supplied by gas; the greater use of household appliances consuming electricity; the use of electricity in new industrial processes; and the expansion of areas supplied. In

1. Compiled from P.E.P. Report, pages 132 and 133; and E.C. R.E.F.S. 1938-39-42-43, Table 18.

competition with gas, electricity has come to be almost universally preferred for lighting purposes. For cooking, heating and various industrial purposes gas probably at least held its own.[1] The radio and a number of domestic appliances such as refrigerators, electric irons and kettles have created a demand for current which did not exist in 1900. New industrial uses for electric current were - as power for machines; for steel smelting (still only to a very limited extent in this country); and for the manufacture of aluminium. There was a continual extension between 1900-39 in the area supplied by electricity. Like water, but unlike gas (to any marked extent), the electricity industry has been able to expand from urban into rural districts. Thus the estimated number of farms supplied with current rose from 4,000 in 1930 to 25,000 in 1935.[2]

The electricity industry continued during the war the expansion of pre-war years. The increased demand came, however, from the expansion of industrial demand, rather than from the increase of the domestic load which had been a feature of pre-war growth.

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1. Cf. p. 98.

2. P.E.P. Report on Electricity, p.35.

Table 71 Electricity Generated in Great Britain (a)[1]

Year	Units generated millions
1921-22	3,890
1938-39	25,058
1939-40	26,984
1940-41	29,320
1941-42	33,402
1942-43	35,436
1946-47	42,223
1947-48	42,895

(a) Note: Figures for 'gross public supply'. Figures for 1947-48 cover only 10½ months for local authorities in Scotland

Output reached a wartime peak in 1944, declining slightly in 1945 with the end of the war, but increasing again in 1946 with the growth of the domestic load. The chief difficulties in the way of expanding the supply of electricity have been the shortage of coal, and of generating plant. The extension of generating capacity is limited by the shortage of building materials, and especially of steel. The 1948 Economic Survey gave the estimated peak generating capacity for the winter of

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1. E.C. - R.E.F.S. 1938-9 - 42-3; M.F.&P. - R.E.F.S. 1947-8; and 23rd Report of Elec. Commissioners, 1950.

1947-8 as 9,530 thousand kw., with a peak demand of 10,950 thousand kw., leaving a deficit of 1,420 thousand kw. It was estimated that peak capacity would be 15,780 thousand kw. and peak demand 14,890 thousand kw. by 1952-53.

B. Variations in consumption levels

The total sales of current per consumer varied considerably from one undertaking to another in 1947-8. The range of consumption per consumer (excluding bulk supplies sold to other undertakings) was from 331.3 units per consumer in Ogmore and Garw U.D.C.'s undertaking to 61.510 units per consumer in Newcastle-on-Tyne, and 59,195 units per consumer in Port Talbot.[1] The Newcastle undertaking was somewhat exceptional as it supplied only a small part of the town and its main sales were for transport purposes. The undertakings with exceptionally low (less than 500 units per consumer) or high (more than 10,000 units per consumer) sales were as shown in Table 72.

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1. Calculated from Min. of Fuel and Power R.E.F.S. 1947-8.

Table 72 Electricity undertakings with very high or very low sales per consumer, 1947-8[1]

Undertakings	Sales per consumer Units
Ogmore and Garw	331.3
Bolsover	381.9
Dolgelly	385.3
Normanton	434.7
Amble	450.4
Dearne	491.5
Newcastle-on-Tyne	61,510
Port Talbot	59,195
Ebbw Vale	21,622
Thornton Clevelys	19,845
Morecambe	10,921
Rotherham	10,471

Other low sales undertakings selling more than 500 but less than 1,000 units per consumer in 1947-8 were - Aberdare, Adwick, Ammanford, Bethesda, Caerphilly, Calne, Castleford, Connah's Quay, Cwmbran, Eston, Guisborough, Hindley, Llanfairfechan, Lyme Regis, Maesteg, Menai Bridge, Middlesbrough, Mountain Ash, Mynyddislwyn, Padiham,

1. Calculated from Min. of Fuel and Power R.E.F.S. 1947-8.

Penmaenmawr, Pontypridd, Redcar, Rhondda, Risca, Seaham, Skelton, Stanley, Tredegar.[1]

Other undertakings with large sales per consumer (selling more than 5,000 but less than 10,000 units in 1947-8) were - Kettering, Luton, St. Helens, Sheffield, Stretford and Wolverhampton.[2]

As was the case with gas[3] industrial sales varied much more than domestic sales, and the undertakings with high sales per consumer all achieved their position because of high sales of power. This may be illustrated by comparing two South Wales undertakings, Ebbw Vale and Tredegar. Their total sales per consumer in 1947-8 were:-

Ebbw Vale	21,622 units[4]
Tredegar	856 units

This great difference in the level of consumption was caused entirely by Ebbw Vale's large power sales - notably to its great steel and tin-plate works. The power sales per head of the two undertakings were:-

Ebbw Vale	21,048 units[5]
Tredegar	107 units

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1. Calculated from Min. of Fuel and Power R.E.F.S. 1947-8.
2. Ibid.
3. Cf. p. 115.
4. Calculated from Min. of Fuel and Power R.E.F.S. 1947-8.
5. Ibid.

Their "domestic" sales, for lighting, heating and cooking were:-

Ebbw Vale	557.0 units[1]
Tredegar	737.3 units

Thus Tredegar actually had higher "domestic" sales than Ebbw Vale.

The following table (73) shows the "lighting heating and cooking" and "power" sales for undertakings in six regional groups.

Table 73 Lighting, heating and cooking and power sales per consumer of electricity undertakings in different regional groups, 1947-8[2]

Undertakings	Lighting, heating and cooking sales per consumer	Power sales per consumer
	Units	Units
WEST RIDING		
Keighley	931.5	1459.0
Bingley	1145.7	710.9
Shipley	1585.4	1065.0
Broadford	1626.8	1336.8
Halifax	1771.1	1323.2
MIDLANDS		
Cannock	1265.2	1444.5
West Bromwich	1272.2	3474.7
Walsall	1747.5	1313.0
Lichfield	1811.1	2100.7
Wolverhampton	2011.4	3339.4

[continued overleaf]

1. Calculated from Min. Fuel and Power R.E.F.S. 1947-8.
2. Ibid.

[continued from preceding page]

SOUTH WALES		
Gellygaer	355.1	29.2
Mynyddislwyn	435.2	107.2
Ebbw Vale	557.0	21048
Bedwellty	676.7	92.5
Tredegar	737.3	107.5
SOUTH COAST		
Hastings	1222.8	293.9
Bexhill	1405.8	101.7
Worthing	1485.4	101.8
Eastbourne	1844.1	181.7
Brighton	3549.7	713.2
SOUTH WEST		
Plymouth	813.3	581.3
Plympton St. Mary	1148.7	322.1
Tiverton	1303.2	608.6
Exeter	1505.9	427.9
Torquay	1921.4	275.0
TEESSIDE		
Middlesbrough	471.5	399.1
Eston	577.3	64.7
Redcar	661.5	218.1
Stockton	1135.1	592.6
West Hartlepool	1188.8	3070.5
GROUP AVERAGES		
South Wales	552.3	4276.9
Teesside	806.8	869.0
South West	1338.5	443.0
West Riding	1412.1	1179.0
Midlands	1621.5	2334.5
South Coast	1901.6	278.5

On the basis of these figures some generalisations about the consumption of electricity may be made. The

power sales per head were very much what would be expected, with a low figure for the non-industrial South Coast and South Western undertakings and higher sales in the industrial areas. It is notable that with the exceptions of West Hartlepool and Ebbw Vale the undertakings in the two areas where the iron and steel and coal industries predominate, South Wales and Teesside, had relatively low power sales. If it were not for the large power sales of Ebbw Vale the South Wales undertakings would have lower power sales than the South Coast group. The coal and iron and steel industries generate most of the electricity which they require for themselves and do not rely upon public supplies. The engineering industries of the Midlands and the textile industry of the West Riding obviously consume considerable amounts of current.

The lighting, heating and cooking sales show some interesting variations. These were highest in the wealthy South Coast area, with its many large houses and hotels. The most interesting aspect of these figures, however, is the remarkably low sales in the Teesside and South Wales areas. To some extent it seems that this must reflect the relative poverty of these areas, although the fairly high "domestic" consumption of the West Riding undertakings makes this conclusion somewhat uncertain. Special factors which may partly explain the low "domestic"

electricity consumption of the South Wales and Teesside areas are the exceptionally low price of gas in part of Teesside (particularly from the Middlesbrough undertaking[1]) and the widespread use of cheap coal which is granted to miners in South Wales. The earlier advent of darkness in the South may also have an appreciable affect on the demand for lighting purposes though it can only be a matter of conjecture whether this may not be counteracted by a greater need for current for domestic heating purposes in the North. Despite these qualifications it seems likely that an investigation of the consumption per head of electricity for "domestic" purposes and of the amount of income per head of the population in different areas would reveal a definite correlation between high incomes and a high level of electricity consumption for lighting, heating and cooking purposes.

The following table (74) shows the consumption of current per consumer, and per head of the population equivalent to those set up under the 1947 nationalisation Act. These figures relate to former company, as well as municipal, undertakings.

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1. Cf. p. 115,121,126.

Table 74. Total sales of current per consumer and per head of population in regions now administered by Area Boards, 1948-9.1

Region	Sales per consumer	Sales per head of population
	Units	Units
South Western	2183	553
South Eastern	2229	638
London(a)	2279	656
Southern	2491	649
Eastern	2684	704
East Midlands	3163	926
North Eastern	3699	888
Merseyside and N.Wales	3740	994
Yorkshire	3754	1006
Midlands	4195	1033
South Wales	5158	1100
(b)		

Notes: a Figures relate to 1947-8

b Figures for North Western Area not available

It is again obvious, for these figures of total sales, that the position of the different regions was determined by

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1. Calculated from Electricity Supply Handbook (3rd. Edition) published by Electricity Times.

their industrial sales. The sales per head of population is obviously closely linked to the sales per consumer. The only differences in ranking under the two headings are between London and Southern, and East Midlands and North Eastern Areas. The following Table (75) shows the list of Sub-Areas of the above Areas with sales of more than 1,000 units per head of population in 1948-9.

Table 75. Sub-Areas selling more than 1,000 units per head of population, 1948-9.[1]

Sub-Area	Sales per head of population Units
Tees	1007
Chilterns	1008
Northamptonshire	1008
Wolverhampton	1189
Birmingham	1214
Cardiff, etc.	1260
S.Staffs. etc.	1290
Coventry	1386
Swansea, etc.	1710
Sheffield, etc.	1843
Northwich, etc.	1960

1. Compiled and calculated from Electricity Supply Handbook (3rd Edition) published by Electricity Times.

The districts covered by these Sub-Areas were:- Tees - North Yorks and South Durham; Chilterns - part of Bucks. and Bedford including Luton and Watford; Northamptonshire - Northants; Wolverhampton - Cannock, Lichfield, Walsall and Wolverhampton; Birmingham - Birmingham, Solihull and Sutton Coldfield; Cardiff (S.Wales Central) - Cardiff and East Glam.; S.Staffs and North Worcestershire - the Black Country, excluding Wolverhampton and Walsall; Coventry - Coventry; Swansea (S.Wales W.Central) - West Glam. and part of Carmarthen, including Llanelly; Sheffield (Yorkshire No.3) - Sheffield and Rotherham; Northwich (Merseyside No.2) - Northwich, Runcorn, St.Helens and Warrington.

Each of these districts has important industries - particularly engineering of various kinds (Chilterns, Coventry, Wolverhampton, S.Staffs. and North Worcestershire, Birmingham), boot and shoe manufacture (Northamptonshire), iron and steel and tinplate (Swansea, Cardiff, Tees, Sheffield), chemicals (Northwich, S.Staffs., Tees) and shipbuilding (Tees). It is noticeable that of the larger cities (over 500,000) only Birmingham and Sheffield show a very high consumption of current per head of population.

The following Table (76) shows the relationship between the number of consumers in the Electricity Areas which were formed under the 1947 Act and the total

population of these areas.

Table 76. Ratio of Electricity consumers to total population in Electricity Areas, 1949.[1]

Area	Total population / No. of electricity consumers
South Wales	4.68
Midlands	4.17
North Eastern	4.17
South Western	3.94
Southern	3.84
Eastern	3.81
Mersey and North Wales	3.76
Yorkshire	3.73
East Midlands	3.49
London	3.47
North Western	3.40

This Table makes interesting comparison with that of total sales per consumer and per head of population in the same area. It is notable that Areas with high sales per consumer and per head, such as South Wales and the Midlands show a relatively low proportion of consumers to total population. This would indicate that a high

1. Calculated from Electricity Supply Handbook, 3rd Edition.

level of sales per head of population is obtained by having high sales per consumer rather than by having a high proportion of consumers in relation to the total population.

C - Load Factor

As it is economically impracticable to store electricity, the incidence of the load factor is particularly important in this industry. The load factor shows the relationship of peak demand to average demand, or more exactly, the ratio of the total kilowatt-hours (units) used to the units which would have been used were the maximum demand in units sustained throughout the year. Maximum demand is equal to twice the largest number of units used during any consecutive 30 minutes period beginning or ending at the hour. It can be expressed as a formula as follows - Load factor =

$$\frac{\text{Units used in year X 100}}{\text{Maximum demand in units X 8760}}\ \%.$$ [1]

Thus the higher the figure for the load factor, the more favourable it is. In 1947-8 the combined load factor for

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1. P.E.P. Report on the Supply of Electricity in G.B., p.41.

all generating stations in Great Britain was 42.0%.[2] The following Tables (77 and 78) show all municipal undertakings with particularly adverse or favourable load factors.

Table 77. Municipal electricity undertakings with load factors of less than 30%.[2]

Undertakings	Load factor %
Bolsover	16.6
Earby	25.8
Tilbury	26.0
Shoreditch	26.6
Bexhill	26.8
Colne	27.2
Skelton and Brotton	27.2
Ulverston	27.6
Hampstead	27.9
Finchley	28.4
Taunton	28.6
Bexley	28.9
Plympton	29.0
Hornsey	29.3
St. Marylebone	29.4
Dorchester	29.6
Atherton	29.7
Worthing	29.9

1. Min. of Fuel and Power R.E.F.S. 1947-8.
2. Ibid.

Table 78. Municipal electricity undertakings with load factors of more than 50%, 1947-8.[1]

Undertakings	Load factor %
Gravesend	50.4
Ebbw Vale	50.5
Stretford	52.1
Kettering	53.5
Worksop	53.7
Leeds	54.7
Swansea	57.7
Clitheroe	59.2
Morecambe	59.7
Port Talbot	60.4
St. Helens	60.4
Rotherham	62.7
Scunthorpe	64.0
Thornton Cleveleys	73.8

The main factor likely to result in a favourable load factor (apart from the operations of Central Electricity Board in choosing some stations as "base load" stations for almost continuous operation) would be the existence of

1. Min. of Fuel and Power R.E.F.S. 1947-8.

a considerable industrial demand falling at off-peak periods. The effect of industrial power demand on load factor will obviously depend upon the type of industry. Any industrial activity, such as a steel works, consuming current during the whole of the twenty-four hour period, will obviously be particularly advantageous in improving the load factor. The load factor may also be improved by the encouragement of off-peak domestic consumptions for purposes such as water heating. The following Tables (79 and 80) show the ratio of sales of energy for power to sales for lighting, heating and cooking for the groups of undertakings with particularly adverse and particularly favourable load factors.

Table 79. Sales of energy for "power" and "lighting, heating and cooking" for municipal electricity undertakings with load factors of less than 30% 1947-48[1]

Undertaking	Load factor %	Power sales / Light, heat and cooking sales
Bolsover	16.6	.09
Earby	25.8	.18
Tilbury	26.0	.04
Shoreditch	26.6	.95
Bexhill	26.8	.07
Colne Valley	27.2	.52
Skelton and Brotton	27.2	.04
Ulverston	27.6	.34
Hampstead	27.9	.03
Finchley	28.4	.21
Taunton	28.6	.16
Bexley	28.9	.02
Plympton	29.0	.28
Hornsey	29.3	.26
St.Marylebone	29.4	.04
Dorchester	29.6	.11
Atherton	29.7	1.6
Worthing	29.9	.07

1. Min. of Fuel and Power R.E.F.S. 1947-8.

Table 80. Sales of energy for power and "lighting, heating and cooking" for municipal electricity undertakings with load factors of more than 50%, 1947-8.[1]

Undertaking	Load factor %	Power sales / Light, heat and cooking sales
Gravesend	50.4	.94
Ebbw Vale	50.5	37.8
Stretford	52.1	6.6
Kettering	53.5	4.4
Worksop	53.7	2.5
Leeds	54.7	.76
Swansea	57.7	1.8
Clitheroe	59.2	2.4
Morecambe	59.7	3.3
Port Talbot	60.4	78.3
St.Helens	60.4	2.8
Rotherham	62.7	8.3
Scunthorpe	64.0	4.6
Thornton Cleveleys	73.8	9.5

These Tables support the conclusion that it is the undertakings with a relatively high industrial demand which have the most favourable load factors. The average ratio of power to "lighting, heating and cooking" sales

1. Min. of Fuel and Power, R.E.F.S. 1947-8.

for the undertakings with a load factor of less than 30% was .28, while that for undertakings with load factors of more than 50% was 11.7. It would also seem that there is a tendency for very small undertakings to have an adverse load factor.

D. The Areas Problem

In the electricity industry the areas problem was more acute than in the other public utility industries, and electricity had gone furthest along the road of transference to a public board by 1939. The Electric Lighting Acts of 1882 and 1888, which encouraged each urban authority to form its own electricity undertaking were passed when the technical conditions of electricity supply made small isolated supply areas an economically sound proposition. By the beginning of the twentieth century the technique of supply had changed very considerably. The invention of the Parsons steam turbine greatly facilitated the large-scale generation of current. The development of alternating current supply made it possible to use electricity for driving machinery. This meant that a huge new potential source of demand was opened. Even before the end of the nineteenth

century it became apparent that the development of the electricity supply industry now required large power stations and supply areas. The restrictions of municipal boundaries were a hindrance to the growth of a cheap and widespread supply of current. In 1898 the report of the Joint Select Committee on Electrical Energy (generally known as the Cross committee, after its chairman, Viscount Cross) led to the approval by Parliament of private bills authorising the formation of power companies. These companies were not subject to the local authorities' right of compulsory purchase as they only sold bulk supplies of current and did not themselves distribute current to ultimate consumers.[1] This is probably an appropriate point at which to emphasise the dual nature of the electricity supply industry. To a greater extent than in gas and water supply, the distribution of electricity can be regarded as a distinct process and may be under different management from the actual generation of the current. It is possible for several towns to draw their current from one large power station, owing to the comparatively low cost of distribution and the close correlation (up to a point) between the size of a generating station and its efficiency.[2] Thus while

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1. P.E.P. Report on Electricity, p.13.

2. Cf. p. 283 et seq.

very few gas distributors do not also manufacture the gas supplied, it was quite common, even before the creation of the Central Electricity Board in 1926, for electricity distributors to purchase the whole of the current supplied from some independent source. Since the building of the grid system it has been possible to distinguish a third section of the industry - high-voltage mains transmission (as distinct from distribution to the consumer).

At the beginning of the twentieth century, then, the structure of the young industry was of a number of local authority undertakings, mostly in the urban regions, and a slightly smaller number of companies (the proportions were roughly 3:2), the great majority of these undertakings generating and distributing current in areas of supply whose boundaries were defined in the Provisional Order or private act authorising the undertakings. Besides these were developing the power companies, which were not tied to rigid boundaries, but could only sell the current which they generated to other authorised undertakings. The power companies could often develop successfully in areas of company distribution, and might enter indirectly into distribution themselves by purchasing a controlling interest in authorised distributing companies. By 1939 a number of large company undertakings were built

up, mainly by absorption and the use of the holding company device. These large company controlled undertakings were not, however, able to provide an adequate solution to the areas problem. Some of the companies, such as the North-Eastern Electric Supply Co., with 282,142 consumers in 1939 and the County of London Electric supply with 347,001 consumers in 1939 did supply an area fairly well integrated geographically.[1] But many of the companies united financially through holding companies were not united geographically and could not take advantage of the economics of large scale production. For example, the Urban Electric Supply Co. was a subsidiary of Edmundson's Electricity Corporation. This Company was itself a holding company, but the geographic situation of the undertakings controlled provided little scope for any economic advantage in their amalgamation. The Urban Electric Supply Co. controlled, among others, undertakings at Dartmouth and Kingswear, Grantham, Stamford, Hawick and (until 1st July, 1939) Glossop. With one undertaking in the North West Region, one in the South West, two in the Mid East, and one in South Scotland, the provision of current from one central generating station was obviously impracticable.

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1. Figures from E.C. - R.E.F.S. 1938-9 - 1942-3.

The Electric Power Supply Corporation went to the extremes of geographical dispersion, within 1938, two undertakings in Central Scotland - Dumbarton and St. Andrews, and one in Cornwall - at Falmouth. Many companies seem to have been interested in controlling electricity undertakings as financial investments rather than in achieving amalgamated supply regions with the resulting advantages of large scale generation. (Some economies, such as the unified purchase of equipment and unified financial management have been possible with geographically dispersed undertakings under the control of one company.) But even where companies have attempted to form themselves into a technically adequate area of supply they have often been greatly hampered by the existence of local authority undertakings which refused to be absorbed. The areas controlled by local authority undertakings were generally densely populated urban regions which would have provided the necessary base load without which the building of a large power station was not an economically sound proposition. Thus, for example, the Lancashire Electric Power Co., with generating stations at Kearsley, Padiham and Radcliffe, could not expand into the territories of the larger towns such as Manchester, Oldham, Bolton and Salford, where

municipal undertakings were established. In 1939 the Company had only 59,586 consumers compared with Salford's 51,467 and Manchester's 184,881.[1] It would have been possible for local authorities to allow power companies to build up technically adequate supply areas if they had been willing to take bulk supplies of current from the companies, and restricted their own activities to distribution. But generally local authorities were unwilling to do this, preferring to operate their own generating stations.[2] One of the few cases in which a power company did build up a large area relying on it for supplies of current was that of the London Power Company which sold 1,428,759 thousand units (net sales - 1,386,035 thousand units) to its four bulk consumers in 1939. (For comparison Birmingham sold 920,206 thousand units in the same year (815,483 net).)[3] Two of the London Power Company's six generating stations were included among the twenty-five most efficient steam generating stations in Britain in 1935.[4]

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1. E.C. - R.E.F.S. 1938-39 - 1942-43.
2. See Ballin, Organisation of Electricity Supply in Great Britain, p.44.
3. Ibid.
4. P.E.P. Report on Electricity, p.132.

The existence of company undertakings did not, then, provide a solution to the areas problem of electricity supply. Local authorities themselves could not break out of their boundaries except to supply "fringe" areas and give supplies in bulk. The electricity supply industry as it was established in Britain in 1900 was incapable of overcoming the areas problem by its normal growth. It was only after the structure of the industry had been materially altered by Parliamentary action that the problem could be tackled at all satisfactorily. The Electric Lighting (Amendment) Act of 1909[1] made possible the issuing of a "Fringe" Order by the Board of Trade. This allowed one undertaking to supply consumers in the area of another undertaking who could be supplied more easily from the lines of the first company. Such an order would only be granted where the second company (whose consumers the first company wished to supply) could not, or would not, supply the consumers concerned. This procedure did something to make electricity area boundaries less rigid and more rational. Under this Act undertakers were compelled to obtain the sanction of the Board of Trade before building a new generating station. The Board could also make a Provisional Order authorising the compulsory purchase

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1. 9 Ed.7, Ch.34.

of land by an undertaking. The 1909 Act also put local authority and company undertakings on the same footing with regard to the giving and taking of bulk supplies of current (authorising the Board of Trade to permit any undertakings to supply in bulk). Nevertheless the main problem remained practically untouched. England continued to lag behind most other industrialised countries in electrical development. During the 1914-18 war the demand for current increased greatly. Existing generating stations were inadequate to meet the demand, and the situation was made more difficult by a shortage of coal. No less than three committees were appointed to suggest reforms in the organisation of the industry - with the immediate object of improving power supplies in industry and economising resources of coal. The first committee was a sub-committee of the Coal Conservation Committee, set up in 1917. Its chairman was Viscount Haldane. The other two committees were the Committee on Electrical Trades, set up under the Chairmanship of Sir Charles Parsons in 1917, and the Electric Power Supply of 1918, of which Sir Archibald Williamson was Chairman.

The Williamson Committee made a number of interesting suggestions. They were concerned that industrial consumers should be able to draw their current from the public supply, and not be compelled to generate their own

current. They recommended dividing the country into sixteen districts, for generation purposes, each district to be organised by a district board. A central body should also be appointed, which would entrust generation and mains distribution to the district boards, supervise the exact organisation of each board, and arrange for the standardisation of frequency and voltage. The central authority were also to have powers to fix maximum prices and limit the dividends payable by company undertakings. The Parsons report was concerned with the development of the supply of current for power, without which the electrical equipment industry could not grow. The Haldane Report also advocated the reorganisation of the industry under a national board. A fourth Committee, that on Electric Power Supply, set up by the Advisory Council of the Ministry of Reconstruction (known as the Birchenough Committee) recommended a single, uniform national system of generation, owned by the state but operated on a "commercial basis". This Committee did not agree that merely regional reorganisation of generation would be satisfactory. The main recommendations of the Williamson Report were, with one vital modification, made into law by the Electricity (Supply) Act, of 1919.[1] This Act

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1. 9 and 10 Geo.5, Ch.100.

created a new central authority for the industry, the Electricity Commissioners. The Commissioners were to be appointed by the Minister of Transport, who now superseded the President of the Board of Trade as the Minister responsible for the electricity industry. The Commissioners were given authority to issue Special Orders permitting the formation of new electricity undertakings, these taking the place of the Provisional Orders issued by the Board of Trade under the Acts of 1888 and 1882. Special Orders were subject to confirmation by the Ministry of Transport and by Parliament. The consent of the Commissioners was made necessary for any extension or new building of power stations and main transmission lines; for the giving or receiving of bulk supplies of current by undertakings; for changes in the type of meter used; and, in the case of local authorities, for the raising of a fresh loan for electricity purposes. The Commissioners were given the duty of collecting statistics and certain judicial functions - as, for example, decision on maximum prices fixed for undertakings.

The Commissioners were given powers to approve the formation of Joint Boards of local authorities, and of a new type of organisation - the Joint Electricity Authority. The J.E.A. was intended to perform the functions of the District Boards recommended by the Williamson Committee.

The main duty to be laid on the J.E.A. was the generation of current and mains transmission. It could also distribute current in areas in which no authorised undertaking was already functioning. The Commissioners could also approve the formation of Joint Electricity Boards, which were amalgamations of two or more local authority undertakings. The great weakness of this part of the Act was that, contrary to the recommendations of the Williamson Report, the Commissioners were given no compulsory powers to form Joint Electricity Authorities. To cope with the complex and urgent areas problem, all that the Electricity Commissioners could do was to try to persuade probably reluctant company and local authority undertakings to form a joint authority to generate the current which they required. By the time of the creation of the Central Electricity Board in 1926 only two Joint Electricity Authorities had been formed. These were the London and Home Counties J.E.A., which was set up in 1925, and the West Midlands J.E.A. formed in the same year. The only other J.E.A. to come into existence was the North-West Midlands Authority, which was created in 1928. After the coordination of generation and mains transmission under the Central Electricity Board was accomplished it seems that there

would have been little advantage in creating new Joint Electricity Authorities. The area covered by the London and Home Counties J.E.A. included (in 1936) 45 local authority undertakings and 36 company undertakings. Besides selling current in bulk the Authority acted as a distributor in the Twickenham, Leatherhead, Dorking, Surbiton, Sutton and Weybridge areas. The West Midlands J.E.A., covered parts of Staffordshire, Shropshire, and Worcestershire. It supplied current in bulk to three local authority undertakings and one company undertaking - Wolverhampton, Walsall and West Bromwich Corporation and the Midland Electric Co., as well as distributing directly in North-east Shropshire. The North-West Midlands Authority also supplied in bulk and distributed directly in part of its area.[1]

The Joint Electricity Authorities which were formed seem to have been reasonably successful. They formed areas comparable, in total demand, with the larger local authority undertakings. This was achieved in areas which included large rural districts and which were divided among a large number of authorised undertakings. The generation of current in a few large power stations was thus made possible. This result, might, of course, have been achieved by the Central Electricity Board after 1926, though probably not so soon in the areas concerned.

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1. P.E.P. Report on Electricity, pp.158-9.

Table 81. Generation. Sale and Purchase of

No. of Consumers	Name	Units Generated	Units Purchased	Units To direct consumer
		Thousands	Thousands	Thousands
128,874	London and Home Counties	945[B] (underlined) / 43[C]	635,814	143,799
13,084	N.W.Midlands	10 / 95,205 (underlined)	180,614	17,645
17,437	W.Midlands	524,921 / 6,776 / 19,353 / 19,732 / 204	506,200	24,191
	(Local authority undertakings of similar size for			
184,881	Manchester	871,658[A] / 136,686 / 2,457	622,387	478,956
160,906	Sheffield	17,036 / 426,227 / 310,761	597,433	551,988
112,525	Nottingham	395,598 / 396	186,587	161,365

Notes: A Local authority figures are for 1939.

B Figures underlined in black are of energy generate under the orders of the Central Electricity Board show energy generated independently. Only these f column "Units Purchased" to give total available f total energy available was 635,857 thousand units.

C Separate figures for each undertaking are for the the undertaking.

1. Compiled from E.C. - R.E.F.S. 1938-9 - 42-3.

energy by Joint Electricity Authorities, 1938.[1]

sold		
	Bulk	Total
	Thousands	Thousands
	471,970	615,769
	160,565	178,210
	474,545	498,736
	61,939	540,895
	60	552,068
	-	161,365

d at power stations by the undertakings concerned
and which was sold to the Board. The other figures
figures not underlined should be added to those in the
or distribution. Thus for London J.E.A.

different generating stations owned by

The London and Home Counties J.E.A. did not own any large power stations, purchasing all its current in bulk. Its two small power stations at Twickenham and Leatherhead closed down in 1939. The North West Midland Authority owned one large power station (total capacity - 37,000 kw.) and one medium station (capacity - 8,600 kw.). The large station at Stoke was a selected station of the Central Electricity Board, an indication that it was (in 1939) among the 117 most efficient stations in England and Wales. Of the five generating stations of the West Midlands J.E.A. four were Selected Stations - Ironbridge, Ocker Hill, Walsall and Wolverhampton, with capacities of 200,000; 35,500; 17,500; and 45,000 kw. respectively.[1] The refusal to grant compulsory powers to the Electricity Commissioners in 1919 made it possible for the Joint Electricity Authority to provide the solution to the problems which beset the industry. Had it been possible to form Authorities throughout the country the story might have been otherwise.

In 1922 the powers of Joint Electricity Authorities were strengthened slightly by the Electricity (Supply) Act[2]

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1. E.C. - R.E.F.S. - 1938-9 - 42-3.

2. 16 and 17 Geo.5, c.51.

of that year. The Electricity Commissioners were given some power to reduce the areas of supply of power companies. The Act also gave powers to J.E.As. to borrow money - subject to the approval of the Commissioners.

It soon became apparent that the Electricity Commissioners, under the limited powers bestowed upon them, could not perform the urgent task of rationalising the electricity industry in this country. In 1925 yet another committee - the Weir Committee was appointed to consider the problem. The Committee discovered that in that year there was 572 authorised undertakings in Britain owning, in all, 438 generating stations. Of these stations only about 50 could be considered reasonably efficient by the standards of the time. The basis of the recommendations of the Weir Committee was the division of electricity supply into two parts - generation and mains transmission, and distribution. Generation and mains transmission were to be entrusted to a national board, and organised on a national basis. The recommendations of the Weir Committee formed the basis of the Electricity (Supply) Act of 1926.[1] A new Public Corporation - the Central Electricity Board was created to control the generation of energy for the whole country. The Board

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1. 16 and 17 Geo.5, c.51

was empowered to choose efficient "Selected Stations" in which generation should be concentrated. These stations were to remain the property of the existing local undertaking, but operated under the orders of the Board. The Central Electricity Board were given powers to close down non-selected stations compulsorily only if they could prove that the Board could supply the current more cheaply than the existing station. In making this calculation, however, while the Board had to consider all its costs of production the existing generating station could exclude capital charges from its costs. This was sufficient to outweigh the reduced cost of generation which the Board could show in its large and efficient selected stations. This weakness in the Board's position led to the continued operation of many non-selected generating stations belonging to companies and local authorities which the Board might otherwise have closed. There was also a tendency for the Board to choose stations as Selected Stations, not on grounds of efficiency alone, but because they could in that way obtain control of stations which would otherwise continue to operate independently. Thus in 1938 there were in all 133 Selected Stations (117 in England and Wales) instead of the much smaller number that had been intended.[1]

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1. The Grid System by R. Gabel, pp.28-32.

The Board had a useful bargaining weapon in closing generating stations under the provision in the Act which said that a bulk supply of energy might be refused to an undertaking unless that undertaking agreed to take all its current from the Board. The Selected Stations of the Board were to be inter-connected by high-voltage transmission lines. This system of interconnection, which has come to be known as the "grid", was begun by the Board in 1927 and completed in 1936. It has two great advantages - the peak load in one area can be supplied from stations outside that area, whose peak may be at a different time; and supplies can be given over the grid to any district affected by a breakdown of its own local generating plant. The first of these has meant an improving of the load factor position, and a considerable saving in the amount of spare plant which is necessary. It is estimated that by 1938 the requirements for spare plant to meet peak loads and breakdowns fell from 83% in 1921-22 to 19% in 1941-42 and 12% in 1947-48.[1]

Another important duty entrusted to the Central Electricity Board was the standardisation of frequency at 50 cycles. This was practically completed by 1936 at a cost of £16,000,000. A large local authority undertaking,

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1. 23rd and Final Report of the Electricity Commissioners. Published 1950, p.6.

which changed its frequency from 40 to 50 cycles was that of Birmingham. This reform made possible the standardisation of equipment and electric motors throughout the country.

The 1926 Act, in effect, nationalised one part of the electricity supply industry. It marks an important step towards the removal of trading functions from local authority control. Municipal electricity undertakings still owned their generating stations and carried out the distribution of current to the ultimate consumers. But their control of the actual operation of the power stations was surrendered to the Board, except in the case of some relatively unimportant non-selected stations. Orders to light up or damp down boilers, and on the amount of current to be generated were given, not by the Electrical Engineer responsible to the local Electricity Committee, but from the Control Room of the Regional Office of the Central Electricity Board. All the current produced in Selected Stations owned by local authorities (and by companies) was sold to the Board. The undertaking could, however, buy back the current required for its own consumers from the Board. The price paid by the Board for the current was the Cost of Production, this including all Overhead charges - rents, insurance, cost of administration, interest on capital, and allowances

for depreciation. For the repurchase of energy by a distributing undertaking there were three possible tariffs. Energy could be purchased by all distributing undertakings at the grid tariff. This tariff was made up of two parts - a charge based on the peak demand, in kw., of the undertaking, adjusted according to the power factor and local rates; and a running charge per unit, adjusted according to the price of coal. The other two alternatives were only open to owners of Selected Stations. The distributing authority could repurchase the current it generated and sold to the Board at cost of production plus a proportion of the Board's expenses in administering and operating the Grid. A final alternative, open to some selected station owners was the hypothetical costs of production if the station had continued to operate independently. Selected station owners requiring more current than was generated in their own stations could purchase it from the Board at the Grid tariff for the Region.

Table 82. Current Generated and Purchased by Municipal Electricity Undertakings owning selected stations 1938-39.[1]

Undertaking and Scheme Area[a]	Capacity of Selected Station[b]	Units generated and sold to C.E.B.	Units generated for own purposes	Units purchased[e]
	kw.	Thousands	Thousands	Thousands
Sunderland N.E.	66,000	21,281	9,502[c]	64,316
Manchester N.W.	Barton - 178,000 Stuart St.- 162,750	871,658 136,686 1,008,344	Nil[d]	622,387
Lincoln M.E.	12,000	5,477	Nil	34,552
Derby,C.	67,500	66,730	Nil	115,139
Norwich,E.	72,500	260,342	Nil	103,103
West Ham S.E.	76,500	148,265	Nil	177,244
Cardiff,S.W.	57,500	81,769	Nil	161,899

Notes: (a) Key to scheme areas - N.E. = North-East; N.W. = North-West (England and N.Wales); M.E. = Mid-East; C = Central; E = East; S.E. = South-East; S.W. = South-West (England and South Wales).

(b) Capacity relates to Plant installed at 31st March, 1943.

(c) This station worked independently for part of the year 1938-39.

(d) Manchester Corporation also owned a non-selected station Bloom Street which generated 2,457 thousand units in 1938-9.

(e) Including, besides energy purchased from the C.E.B., that purchased from other authorised undertakings and from non-statutory suppliers such as collieries.

1. Source: E.C. - R.E.F.S., 1938-9 - 1942-3.

In the above Table the relation between the current generated and that purchased is shown for seven local authority selected station-owning undertakings - one from each of the Areas in England and Wales. The only independent generation was at Sunderland for part of the year, and in a non-selected station at Manchester. Four of the undertakings purchased more current from the Board than they sold to it, while three generated more current than they required themselves. With the continuance of the Board's policy of concentrating production in large and efficient stations the tendency has been for the output of efficient Selected Stations to be expanded beyond the needs of the owning authority, while the less efficient stations have been used less and less, being used to meet peak loads rather than as base load stations. By 1942-3 Sunderland Corporation's power station had expanded its output so that it produced more current than the local undertaking required. The other undertakings all retained the same position as net importers to, or exporters from, the Grid, the production of Manchester Stuart Street, Lincoln, Derby, and Cardiff stations increasing. The output of energy of Manchester Barton station declined slightly (though it was up in 1940 and 1941), that of West Ham and Norwich showing a continued decline throughout the five year period. These changes

appear to have been in part the result of the effect of the war on the demand for electrical energy, especially in West Ham where the number of consumers declined from 56,314 to 38,842 and sales from 163,924 thousand units to 125,028 thousand units in the same period (1938-9 - 1942-3). If this station had been operated independently by West Ham Corporation the result might not have been greatly different. In Norwich the number of consumers and total sales remained comparatively steady (increasing until 1941-2), so that it appears to have been the deliberate policy of the C.E.B. to bring about a continuous reduction (from 260,342 - 189,142 thousand units) in the output of this station. The expansion of the Sunderland station, from an output of 30,783,000 units to 140,412,000 (48,935,000 units more than those required by the Sunderland undertaking itself) is an obvious example of a change which would not have come about under independent local authority control. The effect of the Central Electricity Board's policy on the concentration of generation is discussed further in the section on Electricity.[1]

It now seems that the virtual nationalisation of the generation of electricity was inevitable. Some large

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1. Cf. p.373 et seq.

local authorities, like Birmingham, Liverpool and Manchester could have continued to give a cheap supply of energy to their citizens without the formation of the Central Electricity Board but in most of the country - in rural districts, smaller towns, and not least, in great conurbations, controlled by a multiplicity of local authorities, technical considerations made it essential for generation to be concentrated in a few large power stations. The planning of the Scheme Area, and the construction of the Grid would have been practically impossible except to a national board having the strength of compulsory powers.

The constitution of the Central Electricity Board allowed little room for the direct influence of local authorities on its policies. The example of the Metropolitan Water Board - a kind of super-joint-board, with representatives of a large number of local authorities sitting on it was not followed. The framers of the Act of 1926 abandoned the idea of a representative board in favour of the new conception of a Public Corporation - a small board of experts in administration. The seven members and the Chairman of the Central Electricity Board were appointed by the Minister of Transport - in making the appointments he was instructed to consult representatives

of local authorities, the electricity industry, commerce, industry, transport, agriculture and labour. The personnel of the first Board appointed included one member who had had experience in a municipal electricity undertaking.

Some of the results of the national organisation of electricity generation and the building of the Grid can be illustrated by the savings in money made possible. These savings resulted mainly from the smaller amount of surplus plant required, and from the increased efficiency of stations, measured by the average fuel consumption per unit generated. The saving in the cost of generating plant to the end of 1935 was estimated at over £11,400,000.[1] At the end of 1947, when the Board was absorbed by the British Electricity Authority the Grid system was estimated to be saving £27,000,000 a year. In 1921-22 the average price charged for current was 2.482d. per unit - by 1947-48 this had fallen to 1.123 although the cost of coal had increased very considerably (from 35s. to 49.4d. per ton) in the same period.[2] At least while local authorities retain their present boundaries the advantages of the organisation of electricity generation and mains distribution on a national scale seem to be overwhelmingly strong.

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1. P.E.P. Report on Electricity, p.31.

2. 23rd and Final Report of Electricity Commissioners, 1947-8, p.6.

SECTION 3.

PUBLIC AND PRIVATE OWNERSHIP.

CHAPTER I

Efficiency

Before any attempt can be made to measure or compare the levels of efficiency achieved by municipal and company gas and electricity undertakings it is necessary to clear the ground a little by some general discussion of what is meant by 'efficiency'.

'Efficiency' is, for the economist, both a dangerous and yet a fascinating word. It is dangerous because of the considerably variety of meaning which can be attached to it; fascinating, because behind the word lies the idea of the relative merits of different methods of achieving the same material end, which is close to the heart of the subject matter of economic theory.

It is very apparent that in popular usage 'efficiency' may mean almost anything, and often means almost nothing. If we read a reference in the press to 'the highly efficient British steel industry' this may reflect nothing more than wishful thinking or the impressions of a reporter who has been on a tour of Margam or Corby; it may refer to an engineer's estimate of the technical performance or Open Hearth furnaces; or it may, though this

is unlikely, relate to a comparison with the steel industries of other countries which has taken all the relevant facts into considerations. Many statements on the relative efficiency of publicly owned industry and 'private enterprise' are about as acceptable as would be a judgement on the quality of a book based on the number of words which it contained. Before a precise meaning can be given to the concept of efficiency two questions must be answered. These are - "To what is the efficiency related?", and "What is the end which the 'efficiency' seeks to achieve?"

The first question does not raise any very difficult issues. It is obvious that efficiency is a relative concept. Watt's steam engine was efficient in comparison with Newcomen's, but would be inefficient when compared with modern sources of power. There is no abstract or absolute standard of efficiency, the term must relate to a comparison with actual or hypothetical achievements made in the same industry or process. An engineer may state that an electricity generating station is '25% efficient' (meaning that the calorific value of the outputs of energy is 25% of that of the fuel consumed) but this does not enable us to estimate its efficiency unless this result can be compared with those of other stations.

The second question leads to some rather more

difficult problems. If efficiency is to be judged from the widest viewpoint, that of a nation or community, then it is difficult to disentangle a judgement of the efficiency of the means from the desirability of the end achieved. If we agree that the increase of human welfare, rather than additions to the total volume of production, is the best criterion of economic progress, then it might be argued that 'ultimate efficiency' should be measured in the same way as effectiveness in adding to human welfare. Such a broad definition of efficiency would mean that it could never be measured accurately at all, unless some way could be found of knowing the subjective valuations made by individuals of the utility yielded to them by increments of different commodities. It would also be necessary to make allowances for any utilities or disutilities created for workers by a variation in the methods or systems of production. For practical purposes it is therefore expedient to omit any considerations of the amount of welfare 'created' by different commodities and compare different units producing the same product, taking it for granted that the output of this particular good does in fact represent the best possible use of the resources used up in making it. In studying levels of efficiency in the gas industry, for example, this would mean ignoring all wider

questions of fuel policy, such as whether the production of gas should be increased and that of electricity reduced, or vice versa. Efficiency may then be reasonably taken to mean absolute success in achieving given ends and to exclude consideration of the ends themselves.

This attitude can only be justified as long as it is remembered that the desirability of the ends must in fact be studied, though as a separate issue, which will normall involve 'non-economic' considerations. An exclusive concentration of efficiency thus defined would be undesirable. A process may be carried out by a comparatively efficient method, but the process itself may, in fact, be unnecessary. Organisation and Method experts have sometimes found that records were being kept efficiently, but that the need for the records had passed away. It is usually better (or is ultimately more efficient) to do the right thing inefficiently rather than the wrong thing efficiently.

Even when ends are taken as given, the problem of relating 'efficiency' to ends is still not solved. The 'end' of an industrial enterprise is not simply the production of the relevant commodity, but is something more complex. It is possible to discover at least three ends or purposes which the economist might consider in measuring the efficiency of a firm or industry in producing

a specific good or service (assuming for the sake of simplifying the present argument that the product is homogeneous). 'Efficiency may be judged from the viewpoint of the consumer, or of the producer of the good concerned, or in relation to the welfare of the whole community. These three 'aspects' of efficiency are here called 'consumer's efficiency', 'producer's efficiency', and 'community efficiency' respectively.

To the consumer the purpose of efficiency in the production of a particular good will be the sale of the good at as low a price as possible (again omitting consideration of variation in quality from the discussion). If this end was considered to the exclusion of all others, then it would mean that the way in which the low price was achieved would be irrelevant. Thus in the case of two monopolies supplying the same commodity in different markets, it could be said that from the consumer's viewpoint, the firm selling at the lower price was more efficient, even though it was able to do this because of some factor, such as an advantage in location, which was independent of the control of the management of the concern. With such a definition of the ends of efficiency it would be possible to state that one organisation was more efficient than another without implying necessarily any kind of judgement on the respective managements. In

fact, adopting the price charged to the consumer as the sole purpose of 'efficiency' would mean that efficiency comparisons could only be made in cases of imperfect competition, since under conditions of perfect competition all firms would appear equally efficient. Under imperfect competition comparison would only be possible where there were two or more monopolistic organisations serving different markets, or where a comparison could be made with the hypothetical price that would have been charged if some other form of ownership had existed. By this standard of judgement a publicly owned monopoly would be more efficient than a privately owned one if it could sell more cheaply, even though this was only because no profits were distributed, and had nothing to do with differences in technical efficiency.

To the producer the purpose of efficiency, the objective which it is desired to achieve, will be the traditional maximisation of profits. (The producer may here be identified with the Ordinary shareholder of a joint stock company.) Like the consumer, the producer will not be concerned to differentiate between the different ways in which the end may be obtained. The firm yielding the highest profit will have the greatest 'producer's efficiency' whether this results from technical efficiencies or from having a cheaper supply of raw

materials, or of labour or from some other fortuitous circumstance. An illustration of a possible conflict between 'technical' and 'producer's' efficiency is given below.[1]

In making any estimate of 'economic efficiency' it is necessary to take a wider viewpoint than that of the good of either the consumer or the producer alone. The best starting point in seeking to arrive at a standard for 'economic efficiency' would appear to be what may be called 'community efficiency'. Although, as it has already been argued, it is expedient to exclude comparison of the amount of utility yielded by different goods, consideration of 'community efficiency' must involve consideration of the general good in so far as is affected by material things. If the end of a particular productive process is taken as being desirable, then the main concern of the community will be the expenditure of scarce resources made to attain that end. Other things being the same, the lower the consumption of resources the greater will be the degree of efficiency. There are, however, two 'other things' which might vary, and invalidate this conclusion, and for which allowance must be made if any overall estimate of 'community efficiency' is to be

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1. Cf. p. 215.

made. Firstly, the process of manufacture may involve the creation of some disutilities. It might be that a process which consumed less resources in relation to output also created more disutilities than an alternative method of manufacture, and this factor would have to be taken into consideration in making any final judgement about which was most efficient from the point of view of the community. This distinction is equivalent to that made by Professor Pigou between social and private cost. Secondly a complete estimate of 'community efficiency' must include some allowance for the effects of the distribution of the profit product. If it is accepted that the welfare of a community will be influenced by the way in which income is distributed, and the aim of efficiency, under our present definition, is to promote the welfare of the community, then it follows that the wages and dividend policy of a firm will affect its efficiency. If the welfare of the community demands that income shall be more evenly distributed, then high wages and low dividends will normally need to be counted on the 'plus' side in calculating a firm's 'community efficiency'.

Even the concept of 'community efficiency', with the consideration of the desirablity of alternative lines of production excluded, described here, would be very difficult to calculate in any actual case, however.

If 'economic efficiency' is to refer to any quality which can be measured with any kind of accuracy, then it is necessary to give the concept rather more narrow bounds than those of 'community efficiency'. The best way of simplifying the 'community efficiency' concept would appear to be to remove the influence of the two complicating factors mentioned above; - by assuming, that is, that the disutilities created by different methods of manufacture will be the same, and by assuming that the effects of varying forms of ownership on the distribution of income will be the same. These assumptions will not, of course, always be realistic, and mean that comparisons based on 'economic efficiency' alone will be incomplete.

The basis for actual comparisons or estimates of 'economic efficiency' may thus be taken to be economy in the consumption of all scarce resources, or the relation of inputs to outputs. This concept may be further narrowed down to consideration of production only (ignoring the 'efficiencies' of administration) when it may be called 'operating efficiency', or may be restricted to estimates of the 'efficiency' of one particular process, when it becomes equivalent to 'technical efficiency'. 'Technical efficiency' so defined may not, however, always be the same thing as the 'efficiency' of a particular machine or process when measured by an engineer. This is because

the engineer's measurements may not allow for the additional labour consumed in making the machine itself.

This part of the discussion may be summarised by repeating the definitions of the six possible meanings of the word 'efficiency' which have so far been distinguished. 'Consumer's efficiency' is effectiveness in serving the interests of consumers of a given commodity by providing articles of high quality at the lowest price. 'Producer's efficiency' is effectiveness in achieving a net surplus of income over expenditure in the operation of an enterprise. 'Community efficiency' (which might also be called 'ultimate efficiency' since it is the widest definition), is effectiveness in achieving a given material end in a way which will lead to the making of the maximum net contribution to the welfare of the community. (The meaning of the word 'community' may itself vary, of course. In the context of this definition it may be taken as being equivalent to 'nation'.) 'Economic efficiency is effectiveness in achieving a given material end in a way which will lead to the making of the maximum net contribution to the welfare of the community, excluding any possible affect on welfare caused by the creation of disutilities or by the redistribution of income. A more concise definition, which amounts to the same thing, would be; - effectiveness in attaining a given material end for

the least possible consumption of scarce resources. 'Operating efficiency' is effectiveness in completing the manufacture of a specific good for the least possible contumption of scarce resources. 'Technical afficiency' is the carrying out of one particular process of manufacture for the least possible consumption of scarce resources. These definitions do not, of course, by any means exhaust the possible meanings which can be, or have been given to the word 'efficiency'. In practice these concepts can be varied by making either explicitly or implicitly further assumptions, or by leaving some of the factors out of consideration. As has already been pointed out, 'technical efficiency' is often measured without making any allowance for the expenditure of labour involved in making capital equipment. Similarly estimates of the 'operating efficiency' of a plant (a concept which is often not distinguished from the 'technical efficiency' of a particular process) may not make full allowance for all the relevant expenditure of labour.

The second part of the problem of efficiency measurement is to consider the adequacy of the actual 'measuring-rods' which are available for this purpose. The measures of efficiency found in practice may be classified under two headings, namely those relating to money costs, and those which depend upon measurements of physical inputs

and outputs. The best known 'money' measurement is that of the average cost of production per unit of output. This standard has certain drawbacks as a measurement of 'economic efficiency'. Cost of production figures which exclude interest payments are incomplete, since capital is certainly an input and must be allowed for. Similarly, the term 'cost of production' is normally taken to exclude the element of pure profit, but a complete estimate of inputs must include entrepreneurial effort. A more serious objection arises from the obvious difficulty that money costs do not always give a true picture of real costs. Low production costs resulting from the ability to obtain labour or raw materials relatively cheaply may not indicate any greater efficiency in serving the community. The result of obtaining raw materials more cheaply than other firms will be to benefit the producers, and, possibly, consumers, but it will not be a sign of greater 'economic efficiency' unless the raw materials are bought from another 'community'; - i.e. imported from a foreign country. Lower costs resulting from a superior location do, normally, represent higher 'economic' efficiency since they mean a saving in the labour and raw materials used in transportation. The loan charges paid by a firm will vary according to when the money was raised, and higher loan charges do not necessarily mean

a greater consumption of capital. A difficult problem which arises in this connection is to determine whether a firm with more modern 'labour saving' machinery is more or less efficient than a firm using older machinery which cost less to buy and upon which the loan charges are consequently less. It cannot be assumed that the use of new machinery will reduce 'economic efficiency' merely because calculations show that the burden of additional loan charges will be greater than savings in the cost of labour and raw materials, and that therefore the cost of production will be increased. This would only be true if the welfare of the community was identified with the short term interest of consumers of the good concerned. (The qualification 'short term' must be used because it might be the failure to renew old machinery in an inflationary period would lead utlimately to still higher loan charges when the existing machines finally wore out.)

When it can be made, the most satisfactory measure of 'economic efficiency' will be a direct measurement of the relationship of inputs to outputs. Unfortunately this measurement is often most difficult to make in practice, since units of different raw materials, of capital equipment, and labour, cannot be added together, and if money is used as a common unit then we are back again at cost measurement, with the disadvantages already

mentioned. The physical measurement of efficiency which is most commonly used is that of output per man hour. This measurement is based on the tacit assumption that time and labour are the only scarce resources which need to be taken into consideration. Professor Boulding, in his well known book 'Economic Analysis', argues, for example, that "The most significant concept of economic efficiency therefore, is that of the production of utility per man hour of life". Since utility is not measurable, however, he concludes that: "A rise in output per man hour of human productive activity, therefore, may not unreasonably be regarded as an expression of economic progress."[1] It is difficult, however, to discover any real justification for this exclusive concentration on men and time as the 'ultimate' scarce resources. Supplies of raw materials are not unlimited and their consumption should not be ignored in making estimates of 'economic efficiency'. It is possible that the farming methods which led to the creation of the 'Dust Bowl' in the U.S. might achieve a higher output per man hour of human productive activity' than forms of cultivation which preserve the productivity of the soil, but it would seem strange to describe them as having a higher economic efficiency. The quickest way

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1. Boulding, op.cit., pp. 649-50.

to harvest a crop of apples may be to cut down the tree, but it would be taking a very short term view to regard it as the most efficient one. The designer of a blast furnace which needed a smaller crew of men, but consumed more coke and ore than existing types, would be unlikely to find much enthusiasm for his invention. Output per man hour is, then, only a partial measurement of 'economic efficiency' as it is defined in this discussion, since it does not allow for the consumption of raw materials. As already mentioned, output per man-hour figures may also, in practice, fail to be wholly satisfactory because they are not even a complete measure of the consumption of time and labour. They may not allow for the man hours used in making and servicing the capital equipment used, and in providing the power required to run the machines. A possible complication of any efficiency comparisons based on the relation of inputs to outputs is that the proportions of outputs may vary from firm to firm, and thus involve the making of a judgement of whether, for example, greater consumption of oil in an electricity generation station is offset by reduced consumption of coal.

Some physical measurements of 'efficiency' relate only to the consumption of raw materials. Thus it is possible to measure the 'thermal efficiency' of a gas works or electric generating station by calculating the

ration of the total calorific value of the inputs to that of the outputs (making the assumption, in the case of gas that the by-products are all used for heating purposes).

When the concept of economic efficiency described here is related to the real world it becomes apparent that it is seldom likely that anything more than a very partial and imperfect measurement can be made. There are numerous pitfalls connected with the use of cost of production figures even when these are vailable on a comparable basis. Apart from the theoretical limitations mentioned above the output per man hour measurement may lead to practical difficulties. It may not always be possible to make the assumption that the quality of the output of different firms or units in the same industry is the same. The highly specific nature of much 'technically efficient' machinery may make its use 'uneconomic' where it cannot be used constantly for producing a standard product. An example of a conflict between 'technical' and 'consumer's efficiency' (and also probably between 'technical' and 'economic efficiency) is given in a statement made by a former Chairman of the United Stell Co., referring to 'efficiency plants', - "Unless such plants can operate at full capacity, they are inefficient on the ground of lost time, idle plant,

and idle capital, and plants less elaborate and less modern, but which can operate more regularly, may really be more efficient."[1] (In this instance, cost of production figures would prove a more accurate guide to 'economic efficiency' than would output per man-hour figures.) But though it may not be possible to measure 'economic efficiency' it can be used as a standard in estimating the value of actual 'efficiency' comparisons and estimates.

It is now possible to pass from this general discussion of the meaning of efficiency to a consideration of the actual problems of making measurements and comparisons in the gas and electricity industries.

GAS

In the comparisons attempted in the gas industry efficiency is assumed to mean effectiveness in producing and distributing coal gas with the lowest possible consumption or material resources (including labour and capital), or the relation of all inputs to a given unit of output. This excludes consideration of three main factors which would have to be allowed for in making a wider 'welfare' efficiency comparison. It ignores the

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1. Mr. Hilton, former Chairman of the U.S.Co., cited in Andrews and Benner, Capital Development in Steel, p.168-9.

question of whether the production of gas is itself at the ideal level (whether, for example, welfare would be increased by using some of the coal used by gas works for the generation of electricity). It also fails to take account of the disutilities created by different undertakings and of the effects on distribution of income resulting from the different financial policies of former municipal and company gas undertakings.

There are two advantages associated with the gas industry when attempting to make efficiency comparison measurements. Firstly gas, if measured by thermal content rather than by volume, can be regarded as being, for all practical purposes, a homogeneous product. Secondly, it is possible to measure all the inputs and outputs in the actual manufacture of gas (apart from labour and capital equipment) in one common unit which does not suffer from the disadvantages which are attached to money measurements. This common unit is that of thermal content.

As soon as we turn out attention to the actual making of comparisons, the very great difficulties present become apparent however. It is obvious that to make any significant comparison on an ownership basis the investigation must cover a considerable number of undertakings. The only figures which are available on a comparable basis for most undertakings are those relating to the

price charged for gas, and those from which calculations of thermal efficiency can be made.

There are many difficulties in the way of using price figures in the gas industry as a guide to efficiency. In the first place the relationship between price and cost of production may be different for municipal and company undertakings. The policy on depreciation and reserves may differ, and local authorities are in a different position from companies with regard to the raising of capital. The possible divergence of policy on the building up of reserve funds and depreciation and renewals is less important than different borrowing positions in the long run. If, as has sometimes been suggested, it is true that municipal undertakings make less adequate allowances for depreciation and renewals than do company undertakings, then this should result eventually either in the municipal undertakings having to raise fresh capital to renew their plant, with a consequent increase in the burden of loan charges, or in a deterioration in the quality of the plant with a rise in operating costs. In either case the lowering of the price made possible by having a smaller depreciation allowance should in the long run be counteracted by an increase in cost elsewhere. The different position about raising capital may give a real advantage to the local authority undertakings as a

group. As this does not represent any saving of real wealth, but only a possible redistribution of income, and as the effects of the redistribution of income on welfare have been excluded from the efficiency comparisons attempted here, then the ability of local authorities to raise capital more cheaply than companies (including both loan and share capital in this description) must be regarded as a bias in their favour. Since capital charges make up about 24% of total costs[1] this is obviously a factor which might enable local authorities to charge lower prices than company undertakings, without reflecting any differences in efficiency, when that word is given the meaning assumed in this discussion.

Price will only represent real costs of production (or actual consumption of inputs) then with variations resulting from policy on depreciation and the level of capital charges (there may also be minor variations resulting from differences in the policy on the hire and installation of equipment). But production costs themselves are likely to be an uncertain guide to efficiency for a number of reasons. These are as follows:-

1. Manufacturing costs will vary with the cost of coal, which depends on the distance of the undertaking from

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1. Heyworth Report, 1945, para. 82. Cmd 6699.

collieries supplying suitable gas coal. Coal transport costs make a considerable variation in the final cost of coal to gas undertakings, and a recent investigation showed that in 1946-7 fuel costs amounted to 54.1% of total revenue for a sample of 38 undertakings.[1]

2. Distribution costs will vary with the density of population in the area served. The more densely populated areas with a higher ratio of consumers per mile of main have an advantage in this respect which undertakings in more sparsely populated regions must do without.

3. Distribution costs will also be affected by what may be called the 'intensity' of demand, i.e. - the annual consumption of gas per consumer. Intensity of demand is largely determined by the size of industrial demand in the area, and though it may be influenced by sales policy to some extent, this must be regarded as largely a fortuitous factor.

4. Storage costs will vary with the load factor. The greater the difference between the average and peak demand, the higher the expenditure on storage is likely to be.

5. The cost of collecting payments may vary with the social and economic character of the area. The

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1. Sleeman, Municipal Gas Costs and Revenue, The Manchester School of Economic and Social Studies, Jan. 1950, p.34.

proportion of bad debts would be likely to be higher in 'depressed' areas. Under present conditions, however, this factor is unlikely to be of much importance in affecting total administrative costs.

6. There are important by-products which result from the manufacture of gas, and the income from the sale of these will affect the cost of production of gas, considered separately. The size of this income may be influenced by the condition of the local market for residual products. An undertakings which has an adequate local demand for coke, coal tar, and other by-products may have an advantage over an undertaking which has to go further afield to find a market for these products.

7. Some undertakings have been able to buy supplies of coke-oven gas at a low price, an advantage not available to the majority of undertakings.

It is apparent from the above list of difficulties that a thoroughly satisfactory comparison of the efficiency of different gas undertakings, even with the restricted meaning of the term used here, is unattainable. In order to overcome some of the disadvantage of using prices as a guide to efficiency two methods are used. A few similar undertakings, in which as many as possible of the fortuitous factors were known to be the same, or could be allowed for, are compared; and comparisons are made

between large samples of undertakings in which the various fortuitous factors might be expected to cancel each other out.

The thermal efficiency comparisons are based on the relation of inputs to outputs in the process of manufacture using the formula

$$E = \frac{100\ (bx_1 + cx_2 + dx_3)}{ax_4} \quad \%$$

where E = 1947 thermal efficiency index
a = Coal consumed
b = Coal gas generated
c = Coke made
d = Tar made.
$x_{1,2,3,4}$ = thermal content per unit (tons, gallons or 1000 cu.ft.)

Standard figures for the thermal content of the coal, coke and tar used, based on those used by the Smethwick undertaking of the West Midlands Gas Board in calculating its 'Fuel Expenditure Index'. Actual variations in the thermal content of the coal do not invalidate the calculations as there are corresponding variations in the thermal content of the coke made. Some figures kindly supplied to me by Mr H. Bates, the present Divisional Engineer of No. 2 Division of the West Midlands Gas Board, covering the No. 9 Region of the Gas Engineering Advisory

Board for 1945 are also used, and are described as the '1945 index'. Owing to a slight difference in the method of calculation (an allowance for inputs of oil and outputs of water gas) undertakings tend to show a lower level of thermal efficiency on this index than on the 1947 calculations.

The chief disadvantage of using thermal efficiency comparisons as a guide to efficiency is of course, that they leave out of consideration such important matters as the cost of distribution and storage, administration, and the burden of capital charges. According to figures given in the 'Heyworth' Report[1] total costs are made up approximately as follows:-

Manufacture	35%
Administration . . .	30%
Distribution and Storage	11%
Capital charges	24%
	100%

Operating efficiency will affect only the first of these four constituents of total cost. But even here variation in thermal efficiency will not lead to exactly equivalent variations in the manufacturing costs. The chief

1. Heyworth Report, para. 82. Cmd 6699

manufacturing cost which will not vary with operating efficiency, as measured by the Efficiency Index, is that of labour. Some works may, by their layout and by use of such improvements as mechanical methods of handling the coal, cut down their labour costs (in relation to the quantity of gas made). But such economies will not be reflected in an Index measuring only the thermal efficiency of converting coal into gas and residuals.

The thermal efficiency index does not show any variations between different undertakings in the 'efficiency' with which they produce different products, but only the total relation of inputs to the combined thermal content of all outputs. It might therefore happen that an undertaking could show a higher overall index figure if it varied the make-up of its output, but the state of demand might make this impracticable. Thus an undertaking meeting an increased demand for gas relative to coke might produce more gas and less coke (from the same inputs of coal) even although this lowered its overall thermal efficiency index figure. The following table shows the relationship between overall thermal efficiency, and the ration of coal consumed to the output of each of the three main products.

Table 83 Thermal efficiency indeces and input-output ratios for 4 gas undertakings[1]

Undertaking	Thermal Efficiency Index		Output per ton of coal consumed		
	'1945'	'1947'	Coal gas therms	Coke tons	Tar gallons
A.	64.1	71.6	77.458	.39965	16.709
B.	74.9	74.2	66.798	.50729	10.808
C.	78.2	76.05	65.062	.52835	11.769
D.	79.8	84.2	80.392	.51646	18.576

This indicates that efficiency does not vary equally in relation to all three products. The undertaking with the lowest overall thermal efficiency had the second highest output of gas per ton of coal consumed. It would appear that variations in the output of coke are of most importance in determining rating by the thermal efficiency index. In order to test this proposition a further comparison of thermal efficiency with individual input-output ratios was made.

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1. Calculated from 1947 Min. of Fuel and Power Returns and 'West Midlands Gas Board figures', 1945.

Table 84 Thermal efficiency indeces and input-output ratios for 10 gas undertakings, 1945[1]

Under-taking	'1945 Thermal Efficiency Index' %	Output per ton of coal consumed		
		Coal gas - therms	Coke tons	Tar gallons
E	79.5	64.4	.57	11.0
F	78.9	69.5	.49	17.3
G	78.4	83.5	.445	17.5
H	78.2	72.0	.505	14.5
I	75.3	66.5	.51	9.8
J	73.9	85.6	.41	17.5
K	71.4	66.5	.48	10.0
L	70.7	79.0	.41	17.5
M	69.9	64.6	.47	10.2
N	69.1	72.3	.435	10.1

There was little difference in the range of variation of the gas and coke ratios of the undertakings included in this table. Expressed as percentages of the lowest figure the therms of gas per ton of coal ratio varied by 32.9% and the tons of coke per ton of coal ratio varied by 39.0%. An equal percentage variation in the coke output ratio and the gas output ratio would

1. 'W.Midland Gas Board figures' - 1945.

normally mean that the coke figures would have the greatest influence on the fuel efficiency index. This is because the thermal content of the coke is greater than that of the gas. In the sample included in this table the lowest output of coke was .41 ton, and this would have a thermal content of about 107 therms, whereas the highest output of gas per ton of coal was 85.6 therms. The coefficient of correlation between the thermal efficiency index and the output of gas per ton of coal consumed for the undertakings in the above table was -

$$= \frac{1.221}{\sqrt{14.863} \times \sqrt{54.414}}$$

$$= + \cdot 042935$$

The coefficient of correlation between the index and the output of coke per ton of coal was -

$$= \frac{\cdot 107341}{\sqrt{14.863} \times \sqrt{.0022385}}$$

$$= + \cdot 58848$$

It is possible to calculate a theoretical relationship between thermal efficiency and cost (and price in so far as these two are related). Using the Heyworth Report figures, about 75% of total costs is represented by costs of manufacture. But of total manufacturing costs only about

70% is represented by the cost of coal.

The figures in the following table show the relationship between the two measurements used, price and thermal efficiency, for a random sample of 14 formerly municipally owned undertakings.

Table 85 Price and Thermal Efficiency of a sample of Gas Undertakings.[1]

Undertaking	Price (Domestic) d. per therm	Efficiency Index %	Ranking High Price	Ranking Low Fuel Efficiency
Kendal	16.0	61.99	1	1
Abertillery	15.75	73.16	2	4
Batley	15.0	72.31	3	3
Beverley	14.625	66.53	4	2
Burton	14.0	78.82	5	9
Chelmsford	13.0	76.62	6	7
Heywood	12.25	80.25	7	12
Darwen	12.0	78.17	8	8
Colne	11.5	80.10	9	11
Blackpool	11.125	73.37	10	5
Ilkeston	11.0	76.16	11	6
Birkenhead	11.0	82.59	12	13
Goole	10.625	79.51	13	10
Doncaster	9.125	88.47	14	14

1. Compiled from Min. F.& P. Ret., 1947; and from Preston Rate Return, 1947-7.

This shows a fairly close correlation between high price and low thermal efficiency, as close as might be expected when allowance is made for the many other factors which can affect the price of gas to domestic consumers. Calculation of the coefficient of correlation gave the result $r = -\cdot 798$, showing a fairly strong negative correlation between high price and high thermal efficiency. Some of the differences in the Efficiency Index in this sample are obviously too small to be reflected in the price charged. The influence of thermal efficiency on price is brought out clearly if the instances in the sample are grouped, with steps of five points in the Index included in each group. This is done in the following table (86).

Table 86 Sample of Gas Undertakings grouped according to Efficiency Index and compared with Domestic Price[1]

Index Group %	Mean Price d.per Therm	Average Index No.	No.of Sample in this Group
60-64.9	16.0	61.99	1
65-69.9	14.625	66.53	1
70-74.9	13.958	72.95	3
75-79.9	12.125	77.86	5
80-84.9	11.58	80.98	3
85-89.9	9.125	88.47	1

1. Compiled from Min. F.& P. Ret. 1947; and Preston Rate Return, 1947-7.

The figures in Table 86 show an increase in the price for each decrease in the Efficiency Index Group, or, in other words, that in this sample the price charged to domestic consumers falls as operating efficiency, measured by the Index, increases.

[e.g., Darwen £$\frac{54700}{64400}$ = 75.3%

Exeter £$\frac{181700}{270900}$ = 67.2%

Birmingham £$\frac{3048700}{4156700}$ = 73.3%][1]

It is through saving in the cost of coal that greater thermal operating efficiency will reduce manufacturing costs. Therefore the relationship of the Efficiency Index to price, if all other influences remained the same, would be:- 1% change in Index causes

$$1 \times \frac{70}{100} \times \frac{35}{100} \text{ change in price} = .245\%$$

Some further actual relationships between the Efficiency Index and price are shown in the following Table (87).

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1. Accounts of Exeter, Darwen and Birmingham undertakings, 1947-48, 1946-47, 1947-48 respectively.

Table 87. Operating Efficiency and Domestic Price in Pairs of Similarly Located Gas Undertakings.[1]

Undertaking	Price d.per therm	Efficiency Index %	% Price difference %	% Efficiency Index difference. %
Hoylake	12.875	73.62)	17.0	12.2
Birkenhead	11.0	82.59)		
Darwen	12.0	78.17)	17.0	2.3
Bolton	13.625	76.41)		
Doncaster	9.125	88.47)	15.6	11.3
Goole	10.625	79.51)		
Leeds	10.25	81.89)		
Bradford	12.625	83.75)		
St.Helens	12.5	78.35)	8.7	7.06
Warrington	11.5	83.88)		
Salford	12.375	78.47)	5.1	1.13
Manchester	13.0	77.59)		

The pairs of undertakings in Table 87 were chosen because they were located in the same area and therefore coal transport costs should be approximately equal. The price and Index differences are each measured as percentages of the lower figure. The evidence in the Table supports the conclusion that large differences in thermal efficiency are reflected in the price, but that with small differences of less than about 5% other influences

1. Compiled from Min. F. & P. Ret., 1947, and Preston Rate Return, 1946-7.

will determine the "price ranking" of undertakings. In each of the five pairs of undertakings where greater thermal efficiency was correlated with lower price, the percentage difference in price was considerably greater than would be expected from the percentage difference in thermal efficiency. The average of the price and Efficiency Index differences (excluding Leeds and Bradford) shows a ratio of 12.68: 6-8 or 1.86 : 1 - compared with the hypothetical relationship, calculated above, of .245 : 1. This would indicate that other influences affecting price, such as price policy, managerial efficiency, and cost of distribution, tend to exaggerate the lower domestic price in undertakings with a higher thermal efficiency. In view of the exceptions - of Bradford and Leeds in Table 87 and of those in Table 85 this point cannot be pressed too far, however. It would seem reasonable to suppose that it is managerial efficiency, and efficiency of distribution, which are most likely to vary directly with thermal efficiency. It is difficult to see any reason why 'fortuitous factors' influencing price should favour undertakings having a greater thermal efficiency.

The first actual comparison attempted is between pairs of undertakings which appear to be most nearly alike in respect to the 'fortuitous factors' affecting cost of production. This method of comparison is necessarily restricted to a very few undertakings.

Table 88. Comparison of Prices charged by "similar" company

Undertaking	Total gas available 1,000 cu.ft.	No. of consumers	Intensity Th.per cons.
Rhymney & Aber Gas Co.	671,483[b]	13,115	116.1
Pontypridd U.D.C.	467,886[b]	8,893	176.3
Dudley, Brierley Hill & District Gas Co.	1,099,378	26,148	176.4
Walsall Corp.	1,311,720	28,952	177.4
Liverpool Gas Co.	10,658,845	238,653	187.7
City of Manchester	9,499,313	215,025	177.6
Exmouth Gas Co.	235,348	5,896	173.1
Teignmouth U.D.C.	138,292	3,118	160.2
Derby Gas, Light & Coke Co.	3,948,791[e]	66,138	205.4
City of Nottingham	4,733,130[f]	136,015	151.0

Notes: a Price shown is for ordinary domestic consumers on for large consumers are not shown above 100 therms for prompt payment of accounts, this has been dedu

b Coke-overn gas.

c Scale - up to 45 therms per quarter = 16.75d. per refer to Dudley area.

d Scale - up to 2.25 therms = 12.43d; 2.25-45 = 10.9

e Of this total 2,230,826 (100 cu.ft.) was coke oven

f Of this total 1,308,285 (1000 cu.ft.) was coke ove

1. Statistics from Min.F. & P.Ret.for 1944 and 1947. Prices October, 1948.

and local authority gas undertakings.[1]

Miles of mains	Consumers per mile of mains	PRICE[a] d.per therm
103.75	125.8	12.7
55.5	160.2	12.0
172	152.0	16.75)[c] 15.4)
183	158.2	12.43) 10.97)[d] 10.725)
1371.25	174.0	11.6
1257.75	170.9	14.5
53.25	110.7	14.375
25.25	123.6	19.0
454.75	145.4	9.25
736	184.8	9.06

the "flat" rate. Reductions in price
a quarter. Where a discount is allowed
ted.

therm; 45-90 therms = 15.4d. Figures

7d.; 45 - 427.5 = 10.725d.

gas.

n gas.

from answers to questionnaire, relate to

The basis of this comparison of a small group of undertakings is that each pair of municipal and company undertakings was in a similar, if not identical position in relation to coal supplies and had roughly equal supply areas. The figures for the consumers per mile of main, and for the consumption per head are given, so that, making allowance for these, it would appear that any large differences in price should reflect real differences in the level of efficiency achieved by the undertakings concerned. The only important item excluded from consideration altogether is that of capital charges and profits, this being reserved for discussion in the next chapter. For the purposes of the present discussion it is assumed that if an undertaking charges its consumers a higher price than another undertaking because it has higher 'total capital charges',[1] that this is a sign of lower efficiency.

Of the five pairs of undertakings compared in the above Table, there were what appeared to be significant differences in price in three cases. The two pairs where the prices charged to domestic consumers were very close together may be considered first.

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1. Cf. p.323.

Rhymney & Aber Gas Co. & Pontypridd U.D.C.

Both these undertakings obtained their supplies of gas from coke-ovens so that they had no direct control over the efficiency of the process of manufacture. The Pontypool undertaking, which had the advantages of a more densely populated supply area (measured as consumers per mile of mains), and a higher level of demand (measured as therms sold per consumer) sold its gas slightly more cheaply - the difference being .7d. per therm.

Derby Gas Light & Coke Co. and City of Nottingham

Both these undertakings purchased some of their requirements from the owners of coke-ovens, and both had densely populated inner areas with a large outer supply area. Nottingham had more consumers per mile of main but Derby had a higher level of consumption. The price charged by the Nottingham undertaking was .19d per therm lower than that charged by Derby to ordinary domestic consumers.

In the remaining three pairs the difference in price was sufficiently large to afford prima facie evidence of some difference in the level of efficiency of the respective undertakings.

Dudley & Brierley Hill Gas Co. - Walsall Corporation.

Both these undertakings were operating under very similar conditions as far as consumers per mile of mains and demand in therms per consumer were concerned. Walsall Corporation was supplying gas to its domestic consumers considerably more cheaply than was Dudley Brierley Hill and District company however. Consumers in the Dudley area were paying 16.75d. for the first 45 therms, and 15.4d. per therm for the next 45 therms, while those in Walsall only had to pay 12.43d. for the first 2.25 therms, 10.97d. per therm for the next 42.85 therms, and 10.725d. per therm for subsequent consumption (up to 427.5 therms)

Liverpool Gas Co. - City of Manchester.

Here again the conditions appear to have been very similar, the company undertaking having the slight advantage in the density of consumers and level of consumption per consumer. The price charged by Liverpool was 2.9d. per therm lower than that charged by the Manchester undertaking to domestic consumers.

Exmouth Gas Co. - Teignmouth U.D.C.

The Exmouth undertaking had fewer consumers per mile of mains but a higher level of demand per consumer. The

price of gas in Exmouth was 4.625d. per therm lower than it was in Teignmouth.

The evidence of this small 'pilot' comparison is then that two companies were supplying gas more cheaply than similarly situated municipal undertakings, one local authority undertaking was selling more cheaply than its company 'counterpart', and in the other two instances similarly situated undertakings were charging about the same price to domestic consumers. Before any conclusions can be drawn about the relationship of high price to low efficiency, there are a number of further points which can be investigated relating to these undertakings. Firstly the point arises of whether the same relationship of high and low prices in these pairs of 'similar' undertakings has existed over any considerable period of time. The following Table shows the domestic price charged to consumers of 100 therms in 1935 and 1937.

Table 89. Comparison of prices charged by 'similar' company and municipal gas undertakings, 1935 and 1937.[1]

Undertaking	Price to consumers of 100 therms d. per therm	
	1935	1937
Rhymney & Aber Co.	12.2	12.2
Pontypridd U.D.C.	10.0	10.0
Dudley Brierley Hill Co.	10.0	11.25
Walsall Corp.	10.3	10.4
Liverpool Co.	7.4	7.6
Manchester Corp.	10.0	10.0
Exmouth Co.	9.0	9.0
Teignmouth U.D.C.	11.5	11.5
Derby Co.	7.0	7.5
Nottingham Corp.	7.2	7.2

1. B.O.T. Return 1935 and 1937.

These figures show that there were no great differences in the relative positions of the undertakings, and indicate that undertakings falling into the 'high price' category had been in the same class for a considerable time. The price difference between the Rhymney Co. and the Pontypridd U.D.C. undertaking was larger in both these earlier years, and the price charged by the company has only increased very slightly in 13 years. The Dudley company was actually charging slightly less than Walsall Corporation in 1935, but the price charged by the municipal undertaking was already .85d. per therm lower in 1937. The difference in price charged by the Liverpool company and the Manchester Corporation undertaking was little different in these pre-war years. The company charged 2.6d. per therm less in 1935, 2.4d. less in 1937, and 2.9d. less in 1948. The price charged by the Exmouth company was lower than that of the Teignmouth U.D.C. undertaking in both 1935 and 1937, but the difference was less than in 1948. The prices of the Nottingham and Derby undertakings were close together in both 1937 and 1935.

The next question which must be dealt with is whether the classification of some undertakings as charging relatively high prices on the basis of the charges made for gas consumed by domestic consumers alone may not be misleading. There are two obvious qualifications to the

assumption that undertakings charging more per therm to ordinary domestic consumers are therefore relatively high-price undertakings. These are that differences in the meter rent charged might counteract high prices, and that undertakings charging more to domestic consumers might be charging less to industrial consumers. The following Table shows the meter rents charged by the pairs of undertakings in this test sample.

Table 90. Comparison of meter rents charged by 'similar' company and municipal gas undertakings, 1935 and 1937[1]

Undertakings	Meter rent per year.(For smallest meter provided).	
	1935	1937
Rhymney Co.	4/-	4/-
Pontypridd U.D.C.	4/-	4/-
Dudley, Brierley Hill Co.	5/-	5/-
Walsall Corp.	Free	Free
Liverpool Co.	2/8	2/8
Manchester Corp.	Free	Free
Exmouth Co.	5/-	6/-
Teignmouth U.D.C.	6/-	8/-
Derby Co.	2/-	4/-
Nottingham Corp.	2/8	2/8

The only case in which a higher price undertaking was charging less for the hire of meters xxx than its lower

1. B.O.T. Ret. 1935 and 1937.

priced counterpart was that of Manchester Corporation undertaking. The difference was not very important, and (at 1935 prices) any consumer of more than 12 therms a year would still find that his gas cost less in Liverpool than in Manchester.

The next Table shows the prices charged to industrial consumers (of 5000 therms) in 1937 for the same pairs of undertakings.

Table 91. Comparison of prices charged to industrial consumers by 'similar' gas undertakings, 1937.[1]

Undertaking	Price. d. per therm.
Rhymney & Aber Co.	5.65
Pontypridd U.D.C.	4.56
Dudley & Brierley Hill Co.	7.79
Walsall Corp.	7.25
Liverpool Co.	4.5
Manchester Corp.	7.16
Exmouth Co.	9.0
Teignmouth U.D.C.	11.5
Derby Co.	5.5
Nottingham Corp.	6.2

In every case (with the exception of the Nottingham and Derby undertakings whose prices for domestic supplies were closely related) the undertaking charging more for

1. B.O.T. Ret. 1937.

domestic purposes was also charging more to industrial consumers. In the case of the Liverpool and Manchester undertakings the price difference to industrial consumers was even greater (2.56d. per therm) than was the difference in the price charged to domestic consumers (2.4d. per therm).

Finally, the thermal efficiency of these groups of undertakings may be compared with the prices charged by them.

Table 92. Prices and Operating Efficiency of pairs of similar municipal and company gas undertakings.[1]

Undertaking	PRICE- d.per Therm.	'1947 Thermal Efficiency Index' %
Rhymney & Aber Gac Co.	12.7	a
Pontypridd U.D.C.	12.0	a
Dudley,Brierley Hill & District Co.	16.75 b 15.4	72.46
Walsall Corporation	12.43 c 10.97 10.725	78.56
Liverpool Gas Co.	11.6	82.07
Manchester Corporation	14.5	77.59
Exmouth Gas Co.	14.375	89.99
Teignmouth U.D.C.	19.0	68.07
Derby Gas Light & Coke Co.	9.25	76.76
City of Nottingham	9.06	83.91

Notes:

a No Index can be calculated as these undertakings both purchased all their gas supplies from the owners of coke ovens.

b Scale - Up to 45 therms per Qr.= 16.75d.; 45-90 =15.4d.

c Scale - Up to 2.25 therms = 12.43d.; 2.25-45th.=10.97d.

1. Figures calculated from Min.F.& P.Ret. 1947; Prices from 1948 tariffs.

The figures in the above Table show that in each case the undertakings in each pair which charged the higher price had a lower thermal efficiency - though the difference in price was not proportional to the difference in thermal efficiency.

Even if all the evidence had pointed the same way, there would not, of course, be enough undertakings in the sample examined in detail above, to make any generalisations about the relative efficiency of municipal and company undertakings. But the conclusions drawn from this detailed comparison of a few 'similar' undertakings can be used to test the reliability of conclusions based on much larger samples. This comparison does show that when all allowances are made for differences in the costs of different undertakings there are some undertakings which fall clearly into a relatively high price group. If these higher priced undertakings were in fact, similarly placed in regard to those factors affecting cost over which the management of the undertaking had no control, then they were operating at a lower rate of efficiency judged from the viewpoint of the consumer. The higher price of similarly placed undertakings must have resulted either from lower efficiency (either in manufacture, distribution or administration) or from the existence of a different

relationship between high price and low thermal efficiency. The extent to which differences in price can be accounted for by differences in capital charges and financial practices is considered in the next chapter.

The first general comparison of prices charged by municipal and company undertakings shows the average figures for a large sample covering all parts of the country. This sample covers almost all county borough undertakings in England and Wales (75 out of the total of 83 county boroughs) and most of the non-county boroughs and Urban Districts included in the Preston 'Rate Return' sample

Table 93. Comparison of prices charged by company and municipal gas undertakings in different local authority areas.[1]

Local Authority Area	No.ofCo. undertakings in sample	No.of L.a. undertakings in sample	Co.	L.a.	All Undertakings
County borough	41	34	11.679	11.069	11.39
Non-county borough	107	47	13.28	11.79	12.825
Urban District Council	42	20	13.169	12.956	13.1
Total Sample	190	101	12.91	11.778	12.51

Notes: a. Prices are for domestic consumption of 'flat' rate.

1. Calculated from figures given in "Preston Rate Return" relating to 1946-7.

Table 94. Price distribution of municipal and company gas undertakings.

Price d./therm	County Boroughs		Non-County Boroughs		Urban Districts		Total	
	Co.	L.a.	Co.	L.a.	Co.	L.a.	Co.	L.a.
Under 6.5	-	1	-	-	-	-	-	1
6.6- 7.0	1	-	-	1	-	-	1	1
7.1- 7.5	-	2	-	-	-	-	-	2
7.6- 8.0	1	-	-	-	-	-	1	-
8.1- 8.5	3	2	1	1	2	-	6	3
8.6- 9.0	3	-	-	4	1	-	4	4
9.1- 9.5	3	1	1	3	1	1	5	5
9.6-10.0	2	4	5	1	-	3	7	8
10.1-10.5	1	3	3	1	2	1	6	5
10.6-11.0	3	3	6	5	2	1	11	9
11.1-11.5	1	3	7	5	3	-	11	8
11.6-12.0	7	2	9	5	4	1	20	8
12.1-12.5	1	3	5	6	2	1	8	10
12.6-13.0	4	6	6	6	3	2	13	14
13.1-13.5	-	1	7	2	5	2	12	5
13.6-14.0	5	2	26	2	4	1	35	5
14.1-14.5	2	-	4	-	-	1	6	1
14.6-15.0	-	1	9	3	3	2	12	6
15.1-15.5	1	-	11	-	3	1	15	1
15.6-16.0	2	-	1	1	2	1	5	2
16.1-16.5	-	-	4	-	2	-	6	-
Over 16.6	1	-	2	1	3	2	6	3
TOTALS:	41	34	107	47	42	20	190	101

Table 95. Price distribution of municipal and company gas undertakings - %[1]

Price	Co.bor.		N.C.B.		U.D.C.		Total	
d.per therm	Co.	L.a.	Co.	L.a.	Co.	L.a.	Co.	L.a.
	%	%	%	%	%	%	%	%
Under 7.0	2.4	2.9	-	2.1	-	-	.5	2.0
7.1- 9.0	17.1	11.8	.9	10.6	7.1	-	5.8	8.9
9.1-12	41.5	47.1	29.0	42.6	28.6	35.0	31.6	42.6
12.1-15	29.3	38.2	53.3	40.4	40.5	45.0	45.2	40.6
15.1-18	7.3	-	16.8	4.3	21.4	20.0	15.8	5.9
18.1 & over	2.4	-	-	-	2.4	-	1.1	-
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

In each case these figures show that the municipally owned undertakings sold gas more cheaply. The advantage was most marked in the case of the group of undertakings supplying non-county boroughs. It is interesting to note that the following price comparison between municipal and company gas undertakings was given in evidence before the 1900-03 Joint Select Committee on Municipal Trading -

Average price of local authority gas undertakings = 3s. 0.4 d per 1000 cu.ft.

Average price of company gas undertakings = 3s. 6.2 d per 1000 cu.ft.

1. Based on figures in Preston Rate Return, 1946-7.

It was stated in explanation that local authority areas were "most populous and remunerative".[1]

The next Table shows a comparison of the average domestic prices (to consumers in the inner area of undertakings of 100 therms a year) charged by random samples of 50 municipal and 50 company undertakings for two pre-war years.

Table 96. Comparison of prices charged by samples of company and municipal undertakings in 1935 and 1937.[2]

Sample	Average domestic price	
	1935	1937
	d per therm	
50 company undertakings	11.797	11.653
50 municipal undertakings	10.576	10.5968

Table 97 shows the average prices charged to industrial consumers (of 5000 therms per annum) by the same samples of undertakings as were included in the previous Table.

Table 97. Comparison of prices charged by samples of company and municipal undertakings to industrial consumers in 1935 and 1937.[3]

Sample	Average industrial price	
	1935	1937
	d per therm.	
50 company undertakings	9.528	9.194
50 municipal undertakings.	8.2202	8.5138

1. Report of Joint Select Committee on Municipal Trading, 1900-03, Q.42 - evidence of Sir Courtenay Boyle, Permanent Secretary of the Board of Trade.
2. Calculated from B.O.T. Ret. 1935 and 1937.
3. Ibid.

The next Table shows a comparison of the average domestic prices charged by further samples of 30 company and 30 municipal undertakings, this time chosen from undertakings which had annual sales of more than one million therms in 1938.[1]

Table 98. Comparison of prices charged by samples of large company and municipal undertakings in 1935 and 1937.[2]

Sample	Average domestic price d per therm.	
	1935	1937
30 larger company undertakings	3.395	9.5
30 larger municipal undertakings	8.916	8.903

Table 99 shows a comparison of the prices charged by municipal and company undertakings in a number of regional groups. These groups included all those undertakings sufficiently close together to be in a similar position as far as coal transport costs were concerned. This type of comparison was necessarily confined to those areas where there were a considerable number of both municipal and company undertakings existing

1. Cf. p.253 et seq.

2. B.O.T. Ret., 1935 and 1937.

in reasonable proximity. Thus no such comparison could be made in the London area because of the absence of municipal undertakings.

Table 99. Comparison of prices charged to domestic consumers by samples of company and municipal undertakings in different regional groups. 1937.[1]

Area.	No. of municipal undertakings.	No. of co. undertakings.	Average price d per therm	
			Company	Municipal
South Wales coalfield	13	12	12.44	12.77
West Midlands	9	13	10.19	9.7
West Riding	14	9	10.25	9.29
S.Yorks coalfield	5	5	9.4	10.1
Derby-Nottingham	5	6	10.13	9.81
N.Yorks - S.Durham	5	8	10.66	8.39

The next Table shows the same comparison taking the price charged to industrial consumers (of 5000 therms).

1. Calculated from B.O.T. Ret. 1937.

Table 100. Comparison of prices charged to industrial consumers by company and municipal gas undertakings in different regional groups.1937.[1]

Area.	No.of munic. undert.	No.of co. undert.	Average price d per therm Company	Municipal
South Wales coalfield	13	12	8.75	10.87
West Midlands	9	13	7.12	7.56
West Riding	14	9	5.82	7.42
S.Yorks coalfield	5	5	5.65	5.34
Derby - Nottingham	5	6	7.0	7.25
N.Yorks-S.Durham	5	8	7.71	6.64

The following Tables summarise the comparisons of domestic and industrial prices.

Table 101. Summary of comparison of domestic prices charged by municipal and company gas undertakings.[2]

Basis of sample.	No. of undert.		Price d.per therm.		Amount by which municipal under takings prices lower(-) or higher (+) than co.averages.
	Co.	L.a.	C.o.	L.a.	
Random, 1947	190	101	12.91	11.778	-.1.132
Random, 1935	50	50	11.797	10.576	- 1.221
Random, 1937	50	50	11.653	10.5968	+ 1.0562
Large, 1935	30	30	9,395	8.916	- 0.379
Large, 1937	30	30	9.5	8.903	- 0.597
Regional, 1937	53	51	10.51	10.01	- 0.5

1. Calculated from B.O.T. Ret. 1937
2. B.O.T. Ret. 1935 and 1937, Min.F. & P.Ret. 1947.

Table 102. Summary of comparison of 'industrial' prices charged by municipal and company gas undertakings.

Basis of sample	No.of undert.		Price. d per therm.		Amount by which la.undert.prices lower(-) or higher(+) than Co.averages.
	Co.	L.a.	Co.	L.a.	
Random,1935	50	50	9.528	8.2202	- 1.3078
Random,1937	50	50	9.194	8.5138	- .6802
Regional,1937	53	51	9.01	7.51	+ .5

In every case the sample of municipal gas undertakings was selling gas to domestic consumers at an average price lower than that of the corresponding sample of company undertakings. Except in the Regional groups the municipal undertakings were also charging lower prices to industrial consumers. The price advantage of the municipal undertakings in the random samples was more than double that of the municipal undertakings in special sample of large (sales of more than one million therms in 1938) undertakings. This suggests that the municipal undertakings in the random samples included a larger proportion of larger undertakings (assuming that there is a correlation between large size and low price) or that it was mainly amongst the smaller undertakings that municipal undertakings

had a large price advantage. The price advantage of the municipal undertakings was also smaller in the regional groups of undertakings. This suggests that there were more municipal undertakings in the relatively favourable sites on the coalfields, and that part of the ability of local authority undertakings to charge lower prices was a result of their advantage in location.

Even in these samples of large undertakings, or of regional groups, however, the average prices charged by local authorities was lower. This indicates that they were operating with greater efficiency from the point of view of the consumer.[1] Whether or not the lower price indicated a higher economic efficiency[2] depends upon whether it was a result of some greater efficiency, and consequently lower costs, in manufacture, distribution or management, or a difference in the relationship between total operating cost and price - i.e. a difference in the amount of interest charges plus profits. Attention may now be turned to manufacturing costs, to discover whether it seems likely that the lower average price of municipal undertakings was a result of lower manufacturing costs. As already explained, the thermal efficiency

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1. Cf. p. 205.
2. Cf. p. 205.

measurement used only relates to raw materials consumed and does not allow for differences in labour costs.

Table 103 shows a comparison of two samples of large gas undertakings, using the '1947 Index' method of calculating the thermal efficiencies.

Table 103. Thermal efficiency of large company and municipal gas undertakings. 1947.[1]

Sample	'1947 Thermal Efficiency Index' %
Average of 15 large (sales over 6,000,000 therms per annum) company undertakings	83.23
Average of 15 large (sales over 6,000,000 therms per annum) municipal undertakings	80.04

This Table shows that the company undertakings achieved a higher average level of thermal efficiency of 3.19.

The following Table (104) shows the average thermal efficiency of two further samples of company and municipal gas undertakings, this time using the '1945 index'.

Table 104. Thermal efficiency of Samples of company and municipal gas undertakings situated in the Midlands, 1945.[2]

Sample	Average Thermal efficiency, '1945 index' %
25 company undertakings	73.3
15 municipal undertakings	73.1

1. Calculated from figures in Min. F. & P. Ret. 1947.

2. Information received from West Midlands Gas Board.

This shows that the level of thermal efficiency attained by the two groups was almost identical - the company undertakings having an average index figure only .2 higher than that for the undertakings managed by local authorities.

The next Table shows a further fuel efficiency comparison between two random samples of undertakings. The calculations were based on the '1947 Index' method.

Table 105. Thermal efficiency of random samples of municipal and company undertakings.[1]

Sample	Index 1938.	1944.
20 company undertakings	84.99	86.71
20 municipal undertakings	84.92	85.01

These thermal efficiency comparisons are summarised in the next Table.

Table 106. Summary of thermal efficiency comparisons.

Sample	Group of undertakings with higher average thermal efficiency and amount of Index advantage.
Random, 25 company 15 municipa, 1945.	Companies - 0.2
Sales more than 8 million therms, 15 co. and municipal.	Companies - 2.19
Random, 20 co. and municipal, 1938.	Companies - 0.7
Random 20 co. and municipal, 1944.	Companies - 1.7

1. Calculated from Min.F. & P. Ret. 1938, and 1944.

The evidence of this comparison is then, that the company owned gas undertakings tended to have a slightly higher average level of thermal efficiency than did the municipal undertakings. The difference was, however, small and no generalisations about efficiency could be based on these figures alone. This comparison can, however, be reasonably interpreted as indicating that the ability of municipally owned undertakings to sell at a lower price than company undertakings, was not a result of the superior thermal efficiency of their plants (and a consequent saving in fuel costs).

The next problem which may be considered is that of the relationship of efficiency to size. If there are economies of scale accruing to a particular size of gas undertaking and a bigger proportion of municipal than of company owned gas works approximated to this optimum size, then this would give them lower average costs and allow them to charge lower prices.

Size may be an important influence lying behind differences of operating efficiency, or of efficiency in distribution or management. Factors which may be influenced by size include the operating efficiency of the plant, technical staff skill, general managerial ability, efficiency in operation and management of the distribution system, and the financial skill of the management. In a consideration

of the relationship of size and 'technical efficiency' the 'efficiency factors' may be classified alternatively into two groups - 'efficiency' of apparatus (including both efficiency of manufacturing plant and of the distribution system), and labour skills (including various managerial and technical skills). (The 'technical efficiency' of manual workers will also vary, of course, but this variation will be between individuals rather than between the whole labour force of different undertakings and can be ignored for purposes of comparison. Happier labour management relations might give to one undertaking an unusually efficient force of manual workers, but this can be counted as a product of good management.)

There does not appear to be any firmly established relationship between the size of a manufacturing plant and its 'operating efficiency'. There is no close correlation between the size of a retort house and its 'technical efficiency' as there is between the size and efficiency of an electric generating plant. The efficiency (in terms of cost) of a distribution system depends more on the density of consumers per mile of mains, rather than on the size of the undertaking. Larger undertakings may have some small advantage in being able to manufacture more by-products, such as benzole and ammonium sulphate. Two reasons tend to give to the larger undertakings greater 'technical

efficiency' of management. The larger undertaking can usually pay higher salaries and attract more highly skilled managers. Secondly, a large undertaking provides more opportunity for the division of the managerial function and greater specialisation. The writers of the Heyworth Report suggest that the ability to employ a fully qualified technical staff gives an important advantage to the larger undertakings.[1] On the other hand, certain parts of the managerial function are indivisible, and some undertakings may lose in 'technical efficiency' through being larger than the optimum managerial size.

Opinion is not entirely agreed on the importance of size as a factor determining 'Technical' and 'operating efficiency'. Mr. Chantler, in his study of the industry, comes to the conclusion that "the evidence of statistics does not suggest any positive relation between the size of existing gas undertakings and their efficiency of operation." He does believe, however, that many gains would arise from the amalgamation of small works.[2]

According to the authors of the P.E.P. Report on the Industry, published in 1939, there are no advantages to be gained by increasing the size of a gas undertaking beyond

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1. The Gas Industry, Ministry of Fuel and Power Report, para.86.

2. Chantler, The British Gas Industry.

an output of 1,000,000 therms a year.[1] A report of the "British Gas Council" states - "Size of itself is no absolute criterion of efficiency. There are many small undertakings rendering admirable service, there may be isolated cases of larger undertakings showing room for improvement."[2] The framers of the Heyworth Report are much more inclined to find a correlation between size and 'operating efficiency'. They state "... we find, generally speaking, the order of efficiency of these groups of undertakings [referring to the following classification of gas undertakings:-

Output	No. of Undertakings
Over 10 million therms per annum	30
" 5 " " " " & not exceeding 10	35
" 1.25 " " " " & not exceeding 5	132
" .5 " " " " & not exceeding 1.25	159
Not exceeding .5 million therms per annum	603]

is a function of size, the other factors contributing to efficiency seldom exerting a predominating influence."[3] As mentioned above, it is through the possibility of

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1. P.E.P. Report on the Gas Industry in G.B., p.119.
2. British Gas Council - "The Gas Industry", para.36.
3. The Gas Industry - Ministry of Fuel and Power Report, para.82.

maintaining an adequate technical staff that the authors of this Report consider that size affects efficiency. The minimum size suggested for efficient operation is an output of 1.25 million therms a year.[1]

Whatever size may be chosen as the minimum for 'operating efficiency' it does not follow that gas works with a smaller output are inefficient economically and that their existence is unjustified. It is generally agreed that gas cannot be transported economically over a long distance (more than about twenty miles) by a grid system (except in areas of very high demand or with available coke-oven supplies)[2] so that small isolated districts must continue to rely on local works. It may thus be argued that, in so far as operating efficiency varies with size, the size of local demand is another 'fortuitous factor' for which allowance must be made in any estimate of 'economic efficiency'.[3]

The preceding price and efficiency comparisons have referred only indirectly to the relationship of size to efficiency. Thus in Table 93 it can be assumed that the average size of County Borough undertakings is larger than

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1. The Gas Industry - Ministry of Fuel and Power Report, para.87.

2. Cf. p. 125 et seq.

3. Cf. p. 209.

that of non-County Boroughs, and that non-County Boroughs are larger than the undertakings owned by Urban District Councils. The average price charged by County Borough undertakings to domestic consumers was .721d. per therm lower than that charged by non-County Boroughs and 1.887d. per therm lower than the average price in Urban District Council owned undertakings. This particular sample is based on a few of the larger Urban Districts so that the difference in average size of the non-County Borough and Urban District Council undertakings was not very considerable. With the company undertakings the average price in non-County Boroughs was slightly higher (.111d. per therm) than in the Urban Districts. The local government status basis of classification tends to be less significant for company undertakings since they are more likely to supply gas outside the minicipal boundaries. This same relationship is brought out in Table 96, showing the price distribution by percentages. Simplifying this Table by omitting company undertakings and reducing the number of price groups, the result shown in Table 107 is obtained.

Table 107. Prices charged and Local Government status of municipal gas undertakings.[1]

Price - d. per therm.	Co.Bor.	N.Co.Bor.	U.D.C.
	%	%	%
9.0 & under	14.7	12.7	10.9
9.1 - 15	85.3	83.0	83.2
15.1 & over	-	4.3	5.9
Total	100.0	100.0	100.0

1. 'Preston Rate Return', 1946-7.

As we move from County Borough to non-County Borough to Urban District undertakings the proportion falling in the lowest price group becomes progressively smaller and that in the highest price group progressively larger.

In the following Table (108) undertakings are grouped according to total sales in 1947.

Table 108. Size (annual sales) and domestic price of gas undertakings, 1947.[1]

Annual Sales. Therms.	Av.price of sample d. per therm
5,000,001 and over	11.425
1,000,001-5,000,000	11.400
500,001-1,000,000	13.612
500,000 and less	15.502

In each case a sample of 10 undertakings was chosen at random, except that all undertakings purchasing coke-oven gas were excluded. The Table shows a distinct rise in price for each of the two groups of smaller undertakings, the average price for the 500,001-1,000,000 therms sold group being 2.212d. per therm, and that for the under 500,000 group being 4.102d. per therm higher than the price in the 1-5,000,000 therms group. There is no further

1. Compiled from Min. F. & P. Ret. 1947, Preston Rate Return, 1946-7, and individual gas tariffs, 1948.

reduction in price with increased annual sales beyond the 1-5,000,000 therms per year group. In order to check this conclusion two further samples were taken from each of these groups of larger undertakings. (In the case of the over 5,000,001 therms group the two samples together include all local authority undertakings falling in this group in 1947 with the exception of those buying supplies of coke-oven gas.) These are shown in the following Table (109).

Table 109. Size and domestic price of larger gas undertakings, 1947.[1]

	Annual Sales Therms	Av.price of sample d. per therm.	No.in sample
A	Over 5,000,001	11.089	7
	1,000,001-5,000,000	11.537	10
B	Over 5,000,001	11.287	17
	1-5,000,000	11.469	20

These figures show that the larger undertakings had a very slight price advantage, on the average of the two samples. They appear to bear out the conclusions of the Heyworth Report that there are no significant economies of scale beyond a size of about 1,250,000 therms sold per year.[2]

1. Compiled from Min. F. & P. Ret. 1947, and Preston Rate Return, 1946-7.

2. Cf. p. 368.

The effects of size can also be measured by means of Thermal Efficiency Index calculations.

Table 110. Size and Thermal Efficiency of gas undertakings.[1]

Group of undertakings	Th. Efficiency Index. %	
Average of random sample of 33 undertakings	74.65	
Average of sample of 15 undertakings selling more than 6,000,000 therms in 1947	80.04	
Average of sample of 12 undertakings selling less than 800,000 therms in 1947	70.61	
Estimated average of all local authority undertakings	79.69	(at assumed calorific value =450)

This Table shows a substantial increase in thermal efficiency for the group of larger undertakings.

Table 111. Size and Thermal Efficiency of gas undertakings, 1947.[2]

Annual Sales Therms	Av. thermal efficiency %	No. in sample
5,000,001 and over	79.680	10
1,000,001-5,000,000	78.988	10
500,001-1,000,000	72.681	10
500,000 and less	70.215	8

1. Compiled from Min. F. & P. Ret. 1947.

2. Ibid.

In each case a random sample of undertakings was made, omitting undertakings buying supplies of coke-oven gas (the samples differ from those in the size - price comparison Table). The results of this Table may be compared with those showing size - price comparisons.[1]

This Table shows an increase of efficiency for each increase in the size group. Like the size - price comparison it shows only a small difference between the two larger groups, but a considerable difference between the 500,001-1,000,000 and the 1-5,000,000 group. The advantage in thermal efficiency of the 500,001-1,000,000 group compared with the smallest group was considerably less than the price advantage of the similar group in the size - price comparison Table.

The following Table shows the relationship between size and operating efficiency using the '1945 thermal efficiency index', and with different size groupings.

Table 112. Size and thermal efficiency of gas undertakings in No.9 (Midland) Area of Gas Engineering Advisory Board. 1945.[2]

Annual output. therms	No. in sample	Average thermal efficiency %
0-200,000	6	66.65
200,001-400,000	7	67.46
400,001-600,000	33	68.90
800,001-1,000,000	5	71.60
1,000,001-2,000,000	3	76.87
2,000,001-3,000,000	4	76.75
3,000,001 and over	13	75.67
Total	44	

1. Cf. Tables 100, 101, and 102.
2. Calculated from figures supplied by the Divisional Engineer (H.E.Bates, Esq), No.2 Division, West Midlands Gas Board.

These figures show a distinct tendency for thermal efficiency to increase up to the one to two million therms annual sales group. The small number of undertakings falling into some of these groups makes it impossible to draw any more rigid conclusions from this Table. Thus the apparently good showing of the six to eight hundred thousand therms annual sales group was a result of one undertaking with a relatively high thermal efficiency falling into this group. The next Table (113) shows these figures rearranged into two larger groups.

Table 113. Size and thermal efficiency of two groups of gas undertakings. 1945.[1]

Annual output. Therms.	Thermal Efficiency. %
1,000,000 therms or less	69.52
More than 1,000,000 therms.	76.06
Total average	72.50

These figures show that the group of larger undertakings with sales of more than 1,000,000 therms a year, had an advantage of 6.54 in thermal efficiency. The next Table (114) shows these figures grouped in the same way as those in Table 104.

1. Calculated from figures supplied by Div.Engr. (H.E. Bates) No.2 Division, West Midlands Gas Board.

Table 114. Size and thermal efficiency of gas undertakings. 1945.[1]

Annual Output of Gas Therms.	No. in sample	Average thermal efficiency
		%
5,000,001 and over	5	78.2
1,000,001-5,000,000	15	75.4
500,001-1,000,000	10	72.0
500,000 and less	14	67.7

There are a number of exceptions to the tendency for thermal efficiency to increase with size in the gas industry, and it is evident that, within limits, it is possible for small undertakings to attain a high level of efficiency. There is no such direct link between physical size of the plant and operating efficiency as there is in the electricity industry.[2] For example the above sample included the following figures:

Undertaking A - Total output 1945 = 3,733,797 therms[3]
Sales 1947 = 4,231,121 therms.

'1945 Thermal efficiency index' = 64.1%
'1947 Thermal efficiency index' = 71.59%

1. Calculated from West Midlands Gas Board figures.
2. Cf. p.282 et seq.
3. Calculated from figures in Min. of Fuel & Power Report, and from 'W.Mid.Gas Board figures'.

Undertaking B - Total output 1945 = 2,176,159 therms
Sales 1947 = 2,053,143 therms.

'1945 Thermal efficiency index' = 83.4%
'1947 Thermal efficiency index' = 83.53%

Undertaking C - Total output 1945 = 321,941 therms
Sales 1947 = 367,790 therms

'1945 Thermal efficiency index' = 78.4%
'1947 Thermal efficiency index' = 77.9%

Undertaking A, with the largest output of the three, had a considerably lower thermal efficiency. As a general conclusion, however, it may be stated that there is a tendency for thermal efficiency to increase with size up to an output of one to two million therms a year. Beyond this size there is no clear evidence of any further economies of scale affecting thermal efficiency. Thermal efficiency normally drops comparatively suddenly for the group of smaller undertakings with an output of less than about 100,000 therms a year.

We can now examine the extent to which the former company and municipal undertakings fell into the groups which were likely to have a higher or lower operating efficiency. Table 115 shows the average size of all statutory company and municipal undertakings in 1947.

Table 115. Average size of municipal and company undertakings 1947.[1]

Sample	Average size. Therms sold in 1947
402 company undertakings	3,180,300
212 municipal undertakings	2,854,900

1. Calculated from Min. F. & P. Ret. 1947.

The next Table shows the distribution of samples of company and municipal undertakings into different size groups.

Table 116. Percentage of municipal and company gas undertakings falling into different size groups, 1938.[1]

Sample.	Size groups - Therms sold in 1938.			
	Under 100,001 %	100,001- 500,000 %	500,001- 1,000,000 %	Over 1,000,000 %
100 company undertakings	16	43	18	23
100 municipal undertakings	12	36	19	33

Table 117. Percentage of municipal and company gas undertakings falling into different size groups, 1947.[2]

	Size groups - Therms sold in 1947			
	Under 100,000 %	100,001- 500,000 %	500,001- 1,000,000 %	Over 1,000,000 %
100 company undertakings	13	34	15	38
100 municipal undertakings	3	34	19	44

This evidence shows that although the average size of all company undertakings was larger than that of those owned by local authorities, there was a bigger proportion of company undertakings in the smallest size group, and a

1. Calculated from Min. F. & P. Ret. 1938.

2. Ibid., 1947.

smaller proportion in the largest (over 1,000,000 therms sold) group. The main reason for this was the existence of a number of very large companies in the largest group (e.g. - The Gas, Light and Coke Co. sold 266 million therms in 1947).

Since none of the price comparisons made above were weighted according to the amount of gas sold by individual undertakings, it would seem that the municipally owned undertakings should have had a slight advantage from having more undertakings in the relatively low cost size groups and fewer in the group of small, high-cost undertakings. This factor alone would not account altogether for the ability of municipal undertakings to charge less for the gas which they supplied, and comparisons taken from samples of undertakings in the same size group showed that the municipal undertakings still had a lower average price, though the difference was smaller than that when all size groups were included in the sample.

The main conclusions of this investigation of the comparative levels of efficiency achieved by former municipal and former company gas undertakings may now be summarised. The efficiency comparisons must be based on the only evidence available figures of prices charged, reinforced by measurements of thermal efficiency. The 'pilot examination' of 'similar' gas undertakings illustrated the

number of influences besides efficiency, which can affect the price charged. It also supported the proposition that there is a definite relationship between high price, high cost and low efficiency. The price comparisons showed that the average price of all large samples of municipal undertakings was lower than that of company owned undertakings. This price advantage of the municipal undertakings was reduced, but still existed, when allowance was made for the possible advantage of municipal undertakings in having, on the whole, more favourable locations. The lower price of municipal undertakings was not a result of greater operating efficiency. In most of the comparisons made, the average thermal efficiency of the company undertakings was higher than that of those owned by local authorities. The local authority undertakings had a slight advantage in having a bigger proportion of their undertakings falling into the size groups which approximated to the optimum, but this again was insufficient to account for the lower average prices charged.

Since it does not appear that there were any other factors affecting the relationship between price, cost and efficiency, which were likely to vary according to the type of ownership two possibilities remain. Either the lower average price of the municipal undertakings was a sign of greater average efficiency, or it was the result of a

difference in financial policy. Perhaps this statement should not be made in this manner as though the possibilities were confined to a mutually exclusive 'either or'. Both factors might have some influence on the situation. It is also possible that the ability to finance its enterprices more cheaply might be a sign of superior managerial efficiency on the part of municipal undertakings. The differences in municipal and company financial practice together with the question of their relevance to this efficiency comparison, are considered in the next chapter. For the moment it may be said that the lower average prices of the former municipally owned undertakings indicated either that they were financed more cheaply, or that they achieved some superior efficiency, which (since the evidence showed that they did not operate at a higher level of thermal efficiency) must have been shown in lower labour, distribution, or management costs.

Efficiency measurement and comparison is in some ways an even more difficult and complicated business in the electricity industry, than it is in the gas industry. At first sight it appears that the opposite should be true, because there is considerably more statistical evidence, presented in a more convenient form, available relating to electricity undertakings. The Electricity Commissioners and the Ministry of Fuel and Power have published returns relating to the whole industry showing both prices charged and cost of production. Figures showing the thermal efficiency of power stations have been worked out and published by the Electricity Commissioners. But the interpretation of these statistics and their relation to efficiency (which is taken here as meaning effectiveness in producing and distributing electric energy with the lowest possible consumption of material resources) is by no means an easy task.[1] The main difficulty in making efficiency comparisons in the industry as it existed before nationalisation arises from the "break" between the actual cost of generating energy and

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1. Cf. p. 209.

the price paid by the undertaking for its energy which was caused by the activities of the Central Electricity Board. The following Table shows the relationship between the cost of production and the grid price paid by undertakings owning selected stations which sold more energy to the C.E.B. than they bought back for their own needs, i.e. "exporting" stations. The undertakings sold all their output to the Central Electricity Board at a price equal to the cost of production, and bought back the current which they required for distribution in their own supply area at one of the grid tariffs available to owners of selected stations. The most common tariff for selected station owners was cost of production (adjusted for load and power factors of supply) plus "the equivalent proportion of the Board's expenses in providing maintaining and operating the Grid".[1]

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1. R.Gabel, The Grid System, published by the Association of Engineering and Shipbuilding Draughtsmen.

Table 118 The cost of production and purchase price of energy for "exporting municipal selected station owners, 1947-8 [1]

Undertaking	Cost of production d./unit	Purchase price d./unit	Excess of purchase price over cost of cost of production
Southampton	.72	.74	.02
Torquay	.68	.78	.10
Stepney	.64	.89	.25
Croydon	.61	.75	.14
Hackney	.60	.74	.14
Portsmouth	.60	.75	.15
Plymouth	.59	.76	.17
Brighton	.51	.73	.22
Halifax	.48	.66	.18
Woolwich	.48	.64	.16
Bristol	.47	.71	.24
Manchester	.47	.61	.14
Stockport	.47	.75	.28
Worcester	.47	.73	.26
Bolton	.46	.79	.33
Preston	.46	.62	.16
Birmingham	.44	.56	.12
Gloucester	.44	.74	.30
Burton	.43	.65	.22
Carlisle	.43	.77	.34
Darlington	.43	.65	.22
Liverpool	.43	.54	.11
Warrington	.43	.67	.24
Leicester	.42	.64	.22
Huddersfield	.41	.57	.16
Leeds	.41	.62	.21
Newport	.41	.61	.20
Derby	.40	.57	.17
Lancaster	.40	.67	.27
Stalybridge	.39	.62	.23
Sunderland	.39	.43	.04
Blackburn	.38	.73	.35
Cardiff	.38	.55	.17
Hull	.38	.54	.16
Nottingham	.38	.58	.20
Sheffield	.38	.57	.19
Rotherham	.35	.45	.10
Swansea	.23	.57	.34

1. Min. Fuel and Power, R.E.F.S. 1947-8.

The figures in this Table make it apparent that there is no fixed relationship between the production costs of these undertakings (using "production costs" to mean the total costs of generation excluding loan charges attributable to generation) and the price which they had to pay to the Central Electricity Board for the current which they bought for distributing to the consumers in their area. The difference between the purchase price and the cost of production varied for these undertakings from .02d. to .35d These variations were sufficient to counteract low cost of production in many cases. For example, Swansea, with production costs of .23d. per unit had to pay .56d. per unit for energy bought from the Central Electricity Board, while Birmingham, with an average cost of production of .44d. per unit had to pay only .56d. per unit for its purchases of energy. The price charged by an undertaking will therefore reflect the cost to that undertaking of buying supplies from the Central Electricity Board rather than the actual cost of production. In these circumstances it is difficult to arrive at any satisfactory measure of overall "community efficiency". Low production costs which may be the result of a favourable load factor or of the policy of the Central Electricity Board in choosing some generating stations as "base load" stations which operate for most of

each twenty-four hour period (resulting in low average cost of production per unit) cannot necessarily be taken as an indication of higher operating efficiency. These production costs also exclude (unlike the total production costs on which the price paid by the C.E.B. for purchases of energy from selected station owners was based) loan charges which must be taken into account in estimates of efficiency. Two separate and more limited estimates of efficiency in the electricity industry are therefore made. The operating efficiency is measured by the use of thermal efficiency figures, and by making some reference to figures of cost of production. Secondly price comparisons, related to the price at which current was purchased from the "grid" are used as a measure of the efficiency (from the "community viewpoint") of the distribution and administrative organizations. This second standard may be called efficiency of distribution and reflects the efficiency in distributing current and in administering an undertaking for the lowest possible cost in the consumption of scarce resources of labour and capital.

The following Table (119) shows a comparison of thermal efficiency and generating costs (excluding loan charges) for all municipally owned Selected Stations which were exporters of energy to the "grid" (excluding undertakings which only became exporters when bulk sales of

current to other undertakings were allowed for).

Table 119 The Thermal Efficiency and generating costs of municipally owned generating stations which were exporters of current in 1947-8.[1]

Undertaking	Cost of production d./unit	Thermal efficiency %
Southampton	.72	18.01
Torquay	.68	15.46
Stepney	.64	18.14
Croydon	.61	18.62
Hackney	.60	19.82
Portsmouth	.60	19.77
Plymouth	.59	18.75
Brighton	.51	22.23
Halifax	.48	17.07
Woolwich	.48	20.92
Bristol	.47	20.21) 10.87)
Manchester	.47	19.14] 18.34]
Stockport	.47	20.73
Worcester	.47	21.02
Bolton	.46	19.67
Preston	.46a	20.00
Birmingham	.44	22.36) 10.60)
Gloucester	.44	24.53
Burton	.43	19.41
Carlisle	.43	21.75
Darlington	.43	19.34
Liverpool	.43	23.23) 13.09)
Warrington	.43	21.23
Leicester	.42	20.28
Huddersfield	.41	
Leeds	.41	21.70) 10.51)
Newport	.41	19.19
Derby	.40	20.90
Lancaster	.40	22.46
Stalybridge	.39	21.64
Sunderland	.39	19.11
Blackburn	.38	22.82
Cardiff	.38	19.76
Hull	.38	22.06
Nottingham	.38	21.37
Sheffield	.38	22.96) 21.63)
Rotherham	.35	22.25
Swansea	.23	19.21

Notes

(a) The figure shown in the Return is .16d., but this is an obvious error, and the figure of .46d. per unit was calculated from the figures of units generated and total cost.

1. Min. of Fuel and Power R.E.F.S., 1947-8, and E.C. Gen. E. G.B. 1947.

The above Table does not disclose any obvious correlation between high thermal efficiency and low cost of production. The chief factors besides the thermal efficiency of the works which would be expected to affect the cost of production are the cost of coal, the load factor and labour costs. It seems likely that labour costs would tend to vary with the thermal efficiency, while the other factors would vary independently. Variations in the cost of coal caused by differences in transport costs are, of course, important. Thus in 1948 the Exeter undertaking had to pay 10s. 0d. a ton more in freight charges on its coal supplies than did the Bristol undertaking.[1] In the following Table (120), these undertakings are rearranged into regional groups, in which coal freight charges might be expected to be more nearly equal.

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1. Information obtained in interview with Mr. A.Keet, M.Eng., M.I.E.E. then Electrical Engineer to Exeter Corporation.

Table 120. Thermal efficiency, load factors and generating costs of municipally owned generating stations, arranged in regional groups, 1947-8.1

Undertaking	Cost of production d./unit	Load factor %	Thermal efficiency %
South Coast			
Southampton	.72	30.0	18.01
Torquay	.68	32.8	15.46
Portsmouth	.60	33.2	19.77
Plymouth	.59	39.8	18.75
Brighton	.51	27.6	22.23
Average	.62	32.7	18.84
London			
Stepney	.64	25.4	18.14
Croydon	.61	31.6	18.62
Hackney	.60	32.3	19.82
Woolwich	.48	30.2	20.92
Average	.58	29.9	19.4
Northern Coalfields			
Halifax	.48	32.6	17.07
Stockport	.47	43.6	20.73
Bolton	.46	35.4	19.67
Preston	.46	32.7	20.00
Warrington	.43	38.4	21.23
Darlington	.43	52.2	19.34
Lancaster	.40	52.5	22.46
Stalybridge	.39	42.4	21.64
Blackburn	.38	49.7	22.82
Rotherham	.35	58.5	22.25
Average	.425	43.8	20.72
Bristol Channel			
Newport	.41	41.9	19.19
Cardiff	.38	50.0	19.76
Bristol	.23	65.6	19.21
Average	.34	52.5	19.39

1. Min. Fuel and Power R.E.F.S. 1947-8 and E.C.Gen.E. 1947.

Even when some of the influence of fluctuations in coal costs is removed, by this regional grouping, the correlation between high thermal efficiency and low production costs is not quite so great as might, perhaps be expected. Only in the London group does the ranking by cost of production correspond exactly with ranking by (inverse) thermal efficiency. Thus in the above Table (120) Torquay and Southampton appear to be misplaced, since Southampton had a higher thermal efficiency and a higher cost of production per unit. Stockport despite its considerable advantage in thermal efficiency had a cost of production only .Old. per unit less than that of Halifax, while Bolton, with a lower efficiency had a lower production cost. Similarly, Stalybridge had a lower production cost than would be expected from its thermal efficiency and Load Factor. One possible reason for these discrepancies is the use of a different form of fuel - particularly of the more expensive oil, instead of coal or coke, for firing the boilers. They might also be a result of the coal freight costs not being, in fact, completely equal, or might be caused by the influences of other factors making up "cost of production" which have not been allowed for. These other factors are labour costs; costs of other materials used (oil,

water, and miscellaneous "stores"); and costs of repairs and maintenance of equipment. For the four undertakings Halifax, Stockport, Bolton and Stalybridge the cost of production was made up as follows -

Table 121. Cost of production of four "Northern coalfields" undertakings, 1947-8.[1]

Undertaking	Fuel	Labour	"Repairs, maintenance, oil, water and stores"
	£ per 1000 units generated		
Halifax	1.7037	.16524	.12914
Bolton	1.6601	.14946	.10817
Stockport	1.6911	.09268	.17623
Stalybridge	1.4900	.07126	.07295
Average	1.6362	.11938	.12134

These figures underline the dominating position of fuel costs, which, taking the average of the four undertakings, were 13.7 times greater than labour costs. They also indicate that each of the factors mentioned above had some influence on causing some divergence between the actual ranking by cost of production of these undertakings from that which would exist if thermal efficiency was the only variable affecting cost of production. Thus

1. Calculated from Min. Fuel and Power, R.E.F.S.1947-8.

Stockport had higher fule costs per thousand units generated than Bolton despite its greater thermal efficiency indicating that it must have had to pay more for each ton of fuel consumed. The relatively low production costs of Stalybridge were a result of low labour and "repairs and maintenance, water, oil and stores" costs, as well as of its low fuel costs.

The conclusion of this examination of the relationship between thermal efficiency and the cost of production of energy is that the correlation only becomes very strong when the effects on cost of the variations in coal freights, and the use of different forms of fuel for firing boilers, is eliminated. Thermal efficiency figures are the more satisfactory guide to "operating efficiency"[1] since they are not affected by unavoidable differences in coal freights. They provide only a very partial guide to efficiency however, since they do not allow for labour or maintenance costs, or the consumption of materials other than fuel. None of the "efficiency" tests used here measures success in avoiding "unnecessary" coal freights (and water charges) or efficiency in choosing the optimum site for the location of generating stations.[2] Neither thermal efficiency nor cost of

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1. Cf. p. 210 et seq.

2. Cf. p. 373 et seq.

production figures can be used for any kind of efficiency measurement for the large number of undertakings which did not generate any energy themselves.

In the following Table (122) the thermal efficiency of all steam generating stations whose total hours of generation were not less than 2,400 in 1947, are compared on bases of both size and ownership. These stations include those owned by both company and municipal undertakings, and both selected and non-selected stations.

Table 122. Thermal efficiency of company and municipal steam generating stations, grouped according to size and ownership, 1947[1]

Group No.	Size: Units generated	No. of stations[a]: Company	No. of stations[a]: Municipal	Average thermal efficiency: Company %	Average thermal efficiency: Municipal %
1	1,000,000,000 and over	3	3	24.55	23.97
2	500,000,000-999,999,999	10	7	21.66	20.96
3	200,000,000-499,999,999	8	23	21.04	20.36
4	100,000,000-199,999,999	5	14	19.06	18.05
5	50,000,000- 99,999,999	4	5	15.84	15.65
6	25,000,000- 49,999,999	4	16	15.22	13.49
7	10,000,000- 24,999,999	3	16	12.93	11.66
8	5,000,000- 9,999,999	1	2	13.25	13.11
9	2,500,000- 4,999,999	2	2	10.36	10.50

1. E.C. Gen. of E., 1947.

Note to Table 122.

a Only stations operating the equivalent of "one-shift operation" or 2400 hours generation, included. Where one undertaking owned more than one generating station, each station was included separately, except where "A" and "B" stations existed on the same site, when the average of the two was taken.

The figures in this Table show that in each size group except the smallest (Group I) the stations owned by the company undertakings had a higher thermal efficiency than the municipally owned generating stations.

The evidence contained in this Table also supports the conclusion that size and thermal efficiency are correlated. For both company and municipal undertakings the average thermal efficiency, with the exception of one group, increased with the average size. The exception was the 5,000,000 - 9,999,999 group (8) which, for both companies and local authorities had a higher average thermal efficiency than the next largest group (7) - 10,000,000 - 24,999,999 units. As there were only three stations falling into the 5,000,000 - 9,999,999 units group, however, no particular significance can be attached to this discrepancy, which might be accounted for by the other

main variable factor - the modernity of the plant. The biggest differences in average efficiency were between the groups 4 and 5 (50,000,000 - 99,999,999 units and 100,000,000 - 199,999,999 units) and 1 and 2 (500,000,000 - 999,999,999 units and over 1,000,000,000 units). The differences, taking the averages of the company and municipal undertakings, were of 2.81% and 2.95% respectively. On the evidence of these figures it can be concluded that, within the existing size range of generating stations, thermal efficiency tends to increase with size.

The relative inefficiency of those stations which fall below the average of their group might be caused by their being the smallest stations in the group, or by the lower operating efficiency of the plant, even where total output was the same. The size of the stations was determined by the number and demand of consumers in the undertaking's distribution area, by the policy of the Central Electricity Board (in the case of Selected Stations) and by the undertaking's own policy in concentrating generation in one station, or in operating more than one station. Only the last factor was under the direct control of the managements concerned. In the following Table (123) the position of all the undertakings in group 3 whose thermal efficiency was less than 20% and those in group 4 whose efficiency was less than 18% is analysed more fully.

Table 123. Municipal generating stations with thermal efficiency below average[a] for their size group in 1947[1]

Group 3 - 200,000,000 - 499,999,999 units

Undertaking	Thermal efficiency %	No. of consumers	Total energy generated 1000 units	Total "home" sales 1000 units
Average for group	20.36			
Most efficient in group (Blackburn)	22.82	38,772	395,908	119,477
Hackney	19.82	53,175	203,056	121,984
Portsmouth	19.77	95,933	268,468	189,284
Cardiff	19.76	61,340	273,557	248,463
Bolton	19.67	50,690	235,828	159,646
Norwich	19.47	67,207	235,590	125,697
Darlington (Stuart Street)	19.34	24,325	315,844	83,440
Manchester	19.14	210,562	479,029[c]	816,066
Croydon	18.62	69,170	206,331	146,820
Bradford	18.13	82,623	281,469	262,308
Coventry	16.64	74,385	349,897	336,223

Group 4 - 100,000,000 - 199,999,999 units

Average for group	18.05			
Most efficient undertaking in group (Stretford)	24.70	34,396	187,118	277,750
Halifax	17.07	31,266	121,477	101,059
Torquay	15.46	26,656	110,093	89,039
West Ham	13.62	46,448	140,921	176,229
Liverpool (Lister Drive)	13.09	219,999	116,130[d]	765,951
Birmingham (Prince's Street)	10.60	332,836	104,754[e]	1,357,882

Notes:

a. Only stations with thermal efficiencies below 20% and 18% respectively included.
b. Including sales to the C.E.B.
c. Total generated in three stations operating in 1947, 1,030,779 units.
d. Total generated in four stations operating in 1947, 1,539,398 units.
e. Total generated in three stations operating in 1947, 2,058,110 thou.units.

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1. Min. of Fuel and Power R.E.F.S. 1947-8 and E.C.Gen. E.G.B. 1947.

Two factors emerge clearly from the evidence in this Table. Firstly, the size of the generating plant was not determined solely by the number of consumers and the undertaking's own demand for energy - the variations in the sales more than counterbalance differences in the level of "home" demand in a number of cases. Thus Darlington, with 24,325 consumers and "home" sales of only 83,440 thousand units had a larger total output than Bradford with 82,623 consumers and 262,308 thousand units "home" demand.

Secondly, the relative thermal efficiency of these generating stations did not vary with differences of size within the group. Thus, for example, the smallest undertaking in the group 3, Hackney, had the highest thermal efficiency, while the second largest, Coventry, had the lowest. It can therefore be assumed that the reason for the relatively low thermal efficiency of these undertakings' generating stations was the technical inefficiency of the plant compared with other works of the same size - _ie._, technical factors other than those which were a direct function of size. Indeed the high level of efficiency attained by some comparatively small stations such as Stretford indicates that the higher average thermal efficiency of the larger stations may be a result as much of the fact that larger works generally

having more up-to-date plant, as of the innate technical advantage of bigness itself. This, however, is a problem for the electrical engineer rather than the economist.

A noticeable feature of this list of generating stations falling below the average efficiency of their group is that three of the stations belong to three of the largest municipal undertakings - Birmingham, Liverpool, and Manchester. It is difficult to avoid the conclusion that these large municipal undertakings have not taken full advantage of their size in concentrating production in large stations of the greatest possible thermal efficiency. Birmingham owned two stations at Hams Hall whose combined output put them in the largest group 1, of stations, but whose combined thermal efficiency was the lowest in that group (including company undertakings). The other station, Princes's or Nechells had the extraordinarily low thermal efficiency of 10.6%. Liverpool owned one reasonably efficient group 1 station, and two stations on the same site whose combined output put them into group 4 and whose average thermal efficiency was 13.9, the second lowest amongst all municipal and company undertakings in this group. Manchester had one station in group 2, one in group 3 and one very small non-selected station. The group 2 station had the lowest thermal efficiency of any company or municipal station in

this group while the group 3 station was well below the average for the group. These three large undertakings appear to have had smaller scale stations than their size would appear to warrant, and to have had plant which was relatively inefficient compared with that of other works of the same size. The latter point is probably the more significant since conditions since 1939, with the great increases of demand for current and the difficulty of building new stations has made the continued operation of small scale stations necessary. This does not explain the low efficiency of the plant in these stations however. A comparison of Birmingham, Liverpool and Manchester with Sheffield emphasises that it is the inefficiency of the plant for its size, rather than the unnecessary smallness of scale itself which accounts for the comparatively poor showing of these three undertakings. This comparison, with a summary of the figures mentioned above is contained in the following Table (124).

Table 124. The comparative thermal efficiency and production costs of Birmingham, Liverpool, Manchester and Sheffield electricity undertaking's generating stations, 1947.[1]

Undertaking	Stations owned	Output and size group 1000 units	Thermal efficiency %	Cost of production[a] d.per unit
Birmingham	Hams Hall A	900,567(2)	18.71	
	Hams Hall B	1,058,145(1)	26.75	
	Average Hams Hall A & B	1,958,712(1)	22.36	.44
	Prince's	114,032(4)	10.60	
Liverpool	Clarence Dock	1,398,696(1)	23.23	
	Lister Drive No.I	8,988(8)	-	
	Lister Drive No.III	117,238(4)	15.04	.43
	Average Lister Drive I and III	126,226(4)	13.09	
Manchester	Barton	555,622(2)	18.34	
	Bloom Street	1,387(10)	-	.47 [8.12][b]
	Stuart Street	457,847(3)	19.14	
Sheffield	Blackburn Meadows I	3,834(9)	-	
	Blackburn Meadows II	949,462(2)	23.14	
	Average Blackburn Meadows I & II	953,296(2)	22.96	.38
	Neepsend	328,711(3)	21.63	

Notes: a Total working costs of generation, excluding capital charges.
b The figure .47d. excludes cost of generation at Bloom Street, which was 8.12d. per unit

1. Min. Fuel and Power R.E.F.S. and E.C.Gen. E. G.B.,1947.

The following Table (125) shows a comparison between the operating costs of samples of 30 municipal undertakings and 23 company undertakings (a 100% sample) owning selected stations. Where one undertaking owned more than one selected station the average of the stations was taken.

Table 125. Operating costs of samples of municipal and electricity undertakings, 1947 [1]

1947 Sample		1938	Operating costs d. per unit	
			1947	1938
30	municipal undertakings	20	.7763	.458
23	company undertakings	16	.58174	.397

This evidence bears out the previous conclusion that company owned selected generating stations tend to have a higher "operating efficiency". There is no reason to believe that the company undertakings as a group, were more favourably placed in relation to coal freight charges than the municipal undertakings.

The following Table shows a comparison of the generating costs of company and municipal undertakings with the costs averaged for three separate regional groupings in each of which coal freight costs could be

1. Calculated from Min. of F. & P. R.E.F.S., 1947-8, E.C. R.E.F.S. 1938-9.

assumed to be approximately equal. The relatively small number of company owned Selected Stations made it impossible to extend this method of comparison to other regions. Even in this grouping there were only two company undertakings included in the Lancs.-W.Yorks. area.

Table 126. Generating costs of municipal and company owned electric generating stations in three regional groups 1947-8.1

Area.	No. of Stations.		Average cost. d./unit.	
	Co.	La.	Co	L.a.
Lancs. & W. Yorks	2	13	.405	.549
London	5	6	.64	1.098
Midlands	4	6	.455	.442

Apart from the slightly lower generating costs of the municipal stations in the Midland area, the company undertakings still showed lower average costs - in the London area the difference being greater than that between company and municipal undertakings in the general sample.

It is also possible that the company undertakings may have had lower generating costs because the Selected stations which they owned had, on the whole, more favourable Load Factors. In the following Table, therefore, the average

1. Calculated from Min. F. & P. -R.E.F.S. 1947-8.

generating costs of municipal and company undertakings which had similar station Load Factors are compared.

Table 127. Average generating costs of municipally and company owned Selected Stations falling into the same 'Load Factor group'. 1947.[1]

Ownership	Load Factor Group	No. of Stations	Average generating costs d. per unit
Company	11 - 20	4	.857
Municipal		17	.973
Company	21 - 30	3	.63
Municipal		12	.68
Company	31 - 40	9	.53
Municipal		17	.553
Company	41 - 50	9	.448
Municipal		18	.462
Company	51 - 60	6	.358
Municipal		8	.447
Company	61-70	2	.315
Municipal		3	.33
Company	71-80	1	.28
Municipal		0	-

In this Table where one undertaking owned more than one Selected Station each station was included separately in its own Load Factor group. Stations generating current for less than 2400 hours in 1947 were excluded. Stations

1. Calculated from Min. F. & P. R.E.F.S. 1947-8.

with Load Factors of up to .5 above the limit of each Load Factor group shown, were included in that group.

The figures in this Table show that, while it was true that a larger proportion of company owned Selected Stations fell into the higher Load Factor groups, this did not entirely account for their lower generating costs. In each Load Factor group, the average generating costs of the company owned stations was lower than that of those owned by municipalities.

Generating costs are made up of fuel costs, which will vary with the distance from the source of supply and the thermal efficiency of the plant; labour costs; and maintenance and miscellaneous costs.

The following Table (128) shows a comparison of the labour costs of random samples of 10 municipal and 10 company selected station undertakings.

Table 128. Labour costs of generation of samples of municipal and company electricity undertakings, 1947.[1]

Sample.	Labour costs d. per unit
10 municipal undertakings	.10350
10 company undertakings	.05276

1. Calculated from Min. of Fuel and Power R.E.F.S., 1947-8.

The average labour costs of the company undertakings were thus only slightly more than half those of the municipal undertakings. In order to confirm this relationship two further samples are compared in the following Table (129).

Table 129. Labour costs of generation of samples of municipal and company electricity undertakings, 1947.1

Samples	Labour costs d. per unit
10 municipal undertakings	.11683
10 company undertakings	.06684

This Table again shows that the average labour costs of generation of the company undertakings was little more than half that of the municipal undertakings. The variation in labour costs between different undertakings was remarkably large. The range was from £0.027006 per thousand units (or .0064815 d. per unit) to £1.5727 per thousand units (or .37745 d. per unit). The following Table (130) shows the same samples of 20 municipal and 20 company undertakings rearranged into size groupings and compared.

1. Calculated from Min. of Fuel and Power R.E.F.S. 1947-8.

Table 130. Size and labour costs of generation of electricity undertakings, 1947 [1]

Size Group 1,000 units generated	Average labour costs d. per unit
0 - 10,000	.27146
10,001 - 100,000	.08930
100,001 - 1,000,000	.02682
1,000,001 - and over	.02362

The figures in this Table show a continuous decline of average labour costs with increases in size. The high labour costs of the smallest group of undertakings generating less than ten million units in 1947, is particularly noticeable. The average labour costs of the largest group, generating over a thousand million units in 1947, were very little less (only .0032 d. per unit) than those of the one hundred to one thousand million units generated group. Labour costs therefore appear to reach a minimum at an output of more than one hundred million units a year.

The relatively low labour costs of generation of the company undertakings shown in Tables 128 and 129 may be partly explained by their larger average size. The

1. Calculated from Min. of Fuel and Power R.E.F.S. 1947-8.

size groupings of the 40 undertakings included in the above Table, shown on an ownership basis, was as shown in Table 131.

Table 131. Type of ownership and size groups of samples of municipal and company electricity undertakings[1]

Size group 1000 units generated	No. of undertakings		
	Municipal	Company	Total
0 - 10,000	4	2	6
10,001 - 100,000	10	4	14
100,001 - 1,000,000	6	9	15
1,000,001 - and over	-	5	5
Total	20	20	40

The evidence thus shows quite clearly that the average generating costs of municipally-owned Selected stations were higher than the costs of those owned by companies. This evidence can only be used as an indication of comparable levels of efficiency with extreme caution however. By far the greatest number of electricity undertakings did not own Selected stations, so that these comparisons do not relate to them at all. The Selected stations were operated under the orders of

1. Ibid.

the Central Electricity Board and it is not easy to determine the exact influence of this body on operating efficiency. It is clear that some 'non-economic' considerations influenced the original choosing of Selected stations. A number of municipally owned generating stations in particular were designated as Selected stations more in order to control them than because they were particularly efficient. Obviously the chance of which stations were 'selected' would affect the comparisons of operating costs and thermal efficiencies The selection of a bigger proportion of the less efficient municipal undertakings would create a bias against the local authorities in these comparisons of average thermal efficiencies and operating costs. The influence of the Central Electricity Board on the building of new, and consequently more efficient stations is also another factor making for uncertainty. It would be possible to continue this comparison of operating efficiencies by considering non-Selected stations, but it does not seem that such a comparison would have sufficient significance to make it worth while. The amount of current generated in the non-Selected was relatively small, and the conditions under which they operated varied greatly. The majority of the non-Selected stations only generated

current for very short periods (less than 2400 hours in 1947) and consequently had costs running as high as 18.07d. per unit generated (Gillingham Corporation, 1947). A comparison of undertakings generating current for more than 2400 hours in 1947 was made, but the results are not given here as they appeared to have no real significance. Although the stations were classified on the basis of their load-factor group, the small number of stations and the great variations in size made any conclusions impossible. Some stations with a high load factor were extremely small and had higher generating costs than larger stations which only generated current for less than 2400 hours.

As has already been indicated comparisons of efficiency based on prices charged to the consumer lead to a number of difficulties. Price as an indication of "economic efficiency" is, in the first place, open to all the difficulties associated with cost of production figures. They are influenced by factors which are irrelevant to efficiency comparison and largely outside the control of the managements of individual undertakings, such as, to mention the two most important such influences, load factor and coal freights. The relationship of prices to production costs will be affected by price policy, and

the interest rates which must be paid. The word "price" itself needs further definition - there are two main prices - the "Lighting, Heating and Cooking", or, as it is called here "domestic" price, and the power or "industrial" price. Price comparisons are used here as a measure of efficiency in administration and distribution only. The "grid" price paid by the undertakings for purchases of energy is taken as given and the differences between this and the prices charged is measured. By this method the effect of factors influencing cost of production, but not depending on "efficiency" is eliminated.

The following Table (132) shows a comparison between ten large company and ten large municipal electricity undertakings, all of them being owners of Selected Stations.

Table 132. Statistics of price and size relating to large company and municipal electricity undertakings, 1943[1]

Undertaking	Domestic price d./unit	Power d./unit	Grid price d./unit	Size 1000 units
Companies				
County of London	2.06	.84	.47	1652
Derby and Notts.	2.3	.68	.37	529
Lancashire	1.63	.60	.44	822
Leicester and Warwick	2.08	.86	.49	317
Metropolitan	2.23	1.13	.54	726
North Eastern	2.03	.62	.34	1773
Northmet	1.44	1.12	.48	1110
Shrop. Worcs. and Staffs.	2.00	.80	.41	738
South Wales	1.99	.58	.34	742
Wessex	2.00	.98	.62	414
Local authorities				
Birmingham	1.55	.67	.44	1399
Bristol	1.29	.83	.49	415
Coventry	1.05	.62	.50	413
Hull	1.12	.77	.42	260
Leeds	1.35	.58	.49	365
Liverpool	1.38	.62	.46	670
Manchester	1.56	.62	.46	780
Preston	1.29	.72	.48	274
Sheffield	.83	.47	.38	925
Woolwich	1.08	.95	.54	206
Average - Companies	1.976	.821	.45	882.3
Average - Local authorities	1.250	.685	.466	570.7

Notes

"Domestic price" was the average price per unit charged for energy sold for "Lighting, Heating and Cooking" to both domestic and commercial consumers.

The "Grid price" relates to the price paid for bulk purchases of energy, either from the Central Electricity Board or from other Undertakings. All of the Undertakings included in the sample sold the whole of the energy generated in their stations to the C.E.B., and bought back the current needed for their own consumers, with the exception of Manchester and Wessex. Both of these Undertakings, although buying the bulk of their supplies of current, also had a small supply from their own non-Selected Stations; amounting to 330,000 units for Manchester and 10,530,000 for the Wessex Undertaking in 1943.

1. Compiled from E.C., R.E.F.S. 1938-9 - 42-3.

In the prices charged to consumers the local authority undertakings had a considerable advantage, both for Light, Heating and Cooking and for Power. The average "domestic" price was .726d. lower for the municipal undertakings, and the average price for power was .136d. lower. The average "domestic" price of the municipal undertakings was .784d. per unit higher than the "grid" price paid, while the power price was .219d. per unit higher. For the company undertakings the corresponding prices were 1.526d. and .371d. higher than the "grid" price. One qualification must be introduced before deducing that the municipal undertakings were more efficient in their distribution systems or in raising capital however. This is the density of consumers per mile of main was probably considerably higher for the municipal undertakings, and the cost of distribution would consequently be lower. The Electricity Commissioners Returns do not show the mileage of mains so that no figures of consumers per mile of main can be calculated. The map of electricity areas, however, shows that the areas supplied by the companies were generally much more scattered than those of the municipalities.[1] It was a feature of the structure of the industry that the densely

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1. Ordnance Survey, Electricity Statutory Supply Areas, 1946, (two sheets).

populated urban areas tended to be supplied by local authorities, while the rural areas of less intensive demand were left to the companies.

In the following Table (133) some pairs and groups of company and municipal undertakings are compared, inwhich the undertakings in each pair or group had areas roughly similar in size.[1]

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1. Ordnance survey, Electricity Statutory Supply Areas, 1946, (two sheets).

Table 133. Comparison of Company and municipal electricity undertakings with areas of similar size, 1943.[1]

Undertaking	Size[a] 1000 units	Domestic[b] price d./unit	Power price d./unit	No. of consumers	Grid[c] price d./unit	Domestic and power prices - Grid price d./unit
Wolverhampton	254,729	1.31	.56	48,790	.47	(D) .84 (P) .09
Midland Electric[d]	328,779	2.13	.67	69,848	.48	(D) 1.65 (P) .19
Norwich	100,957	1.69	1.08	60,645	.49	(D) 1.20 (P) .59
Luton	248,899	1.08	.60	41,087	.46	(D) .62 (P) .14
Northampton[d]	165,754	1.44	.87	56,944	.53	(D) .91 (P) .34
Spalding	6,342	1.93	1.27	6,419	.67	(D) 1.26 (P) .60
Boston[d]	9,412	2.73	1.78	8,938	.65	(D) 2.08 (P) 1.13
Watford	96,683	1.07	.70	33,134	.50	(D) .57 (P) .20
Cambridge[d]	31,162	2.04	1.33	22,384	.75	(D) 1.29 (P) .58
Lancaster	82,302	1.20	.66	14,572	.53	(D) .67 (P) .13
Chester	49,403	1.48	.78	22,901	.57	(D) .91 (P) .21
Birkenhead	169,385	1.52	.62	51,946	.59	(D) .93 (P) .03
Mid-Cheshire[d]	97,915	1.58	.65	17,192	.53	(D) 1.05 (P) .12
Mersey[d]	279,420	1.74	.67	28,517	.51	(D) 1.23 (P) .16
Battersea	66,299	1.91	.87	30,555	.65	(D) 1.26 (P) .22
South London[d]	68,418	1.90	1.3	43,810	1.0	(D) .90 (P) .30

Notes (a) This figure refers to the total number of units generated and/or purchased in 1942-3.
(b) Domestic price is average price received for "Lighting, Heating and Cooking".
(c) "Grid Price" - average price paid per unit of energy purchased.
(d) Company undertakings underlined.

1. E.C. - R.E.F.S. 1938-9, 42-3.

In the first pair, the municipal undertaking, Wolverhampton, added a smaller "margin" to the "grid" price for both domestic and power sales than did the company undertaking. The figures suggest that Wolverhampton had greater "selling" efficiency. In the second group the company undertaking had a smaller margin between "grid" and selling prices for domestic and power sales than Norfolk, but had a higher margin than Luton. The supply area of the Norwich undertaking appears to have been less densely populated with consumers than that of Northampton while Luton had a smaller and more densely populated supply area. These figures do not indicate any great differences of "selling efficiency" between these three undertakings. In group three Spalding, the municipal undertaking, had a smaller margin for both domestic and power sales. The company undertaking had a larger supply area and more consumers. The figures suggest that Spalding undertaking had a higher "selling efficiency". In group four, Watford, the municipal undertaking was able to sell current atalower margin over its grid price for both domestic and power sales. The company undertaking had considerably fewer consumers in a slightly smaller area. Watford had much larger sales of current for power. In group five the Mersey company had the highest domestic

price margin and the second highest power price margin. Its domestic sales were smaller than those of the Chester undertaking (20,282 thousand units against 26,011 thousand units). The two areas were very similar in size and population, so that it seems fair to conclude that the company undertaking served its industrial power consumer with greater "selling efficiency" while the municipal undertakings served their domestic consumers better. The most interesting comparison in this group is, however, between the Mid-Cheshire Co., and the Lancaster municipal undertaking, as these operated under the most nearly similar conditions. There was little difference in the size of supply areas, the number of consumers, or "intensity" of demand (Lancaster energy available per consumer = 5.9 thousand units, Mid Cheshire, energy available per consumer = 5.8 thousand units). The domestic price "margin" of the municipal undertaking was .38d. per unit lower than that of the company, while its power price "margin" was .01d. per unit higher. Lancaster also sold 24,504 thousand units as bulk supplies to other authorised undertakings at .59d. per unit. In this case the figures appear to indicate that the municipal undertaking was able to operate with slightly greater "selling efficiency" than was the company. In the last group the municipal undertaking had a higher

domestic price margin but a slightly lower power price margin. Battersea had the advantage of a slightly more compact supply area and of a higher demand per consumer. The general conclusion of this comparison is that the municipal undertakings, judged by the price charged for "domestic" and power purposes, appear to have had a higher "selling efficiency" than similarly situated company undertakings.

The following Table (134) shows a comparison based on the prices charged to domestic and power consumers and their relationship to the "grid" price for a larger sample of company and municipal undertakings. The sample was of 20 company and 20 municipal undertakings taken from selected station owning undertakings, excluding any which generated any current for their own direct use (i.e., in non-selected stations) as this would be a factor affecting production costs not shown in the "grid" price figure. The company "sample" covered all company undertakings in this category.

Table 134. Price comparison between municipal and company selected station owning undertakings, 1947.[1]

Sample	Average "domestic" price	Average power price	Grid price	Average "domestic" price - "grid" price	Av. power price - "grid" price
		d. per unit			
20 municipal undertakings	1.283	1.057	.7285	.5545	.3285
20 company undertakings	1.737	1.1615	.6575	1.0795	.504

1. Calculated from Min. Fuel and Power - R.E.F.S. 1947-8.

The next Table (135) shows a similar comparison for samples of undertakings not owning selected stations (and also excluding those owning non-selected stations).

Table 135. Price comparison between municipal and company electricity undertakings not owning generating stations, 1947[1]

Sample	Average domestic price	Average power price	"Grid" price	Average domestic price - "grid" price	Average power price - "grid" price
		d. per therm			
30 municipal undertakings	1.60	1.243	.797	.805	.446
30 company undertakings	2.007	1.624	.884	1.123	.740

The evidence of the figures in Tables 146 and 147 supports that of the previous Tables 144 and 145. The figures show that municipal undertakings were able to charge lower average prices to both domestic and power consumers than the company undertakings. The average "margin" added to the "grid" price was .525d. per unit lower for domestic supplies sold by the selected station owning municipal undertakings, and .1755d. per unit lower for power supplies. For the undertakings not owning generating

1. Calculated from Min. Fuel and Power, R.E.F.S. 1947-8.

stations, the municipal price "margin" was .320d. per unit lower for "domestic" supplies, and .294d. per unit lower for power supplies. The company selected station owning undertakings had a slightly lower "grid" price as might be expected from the evidence on thermal efficiency.[1] The sample of municipal undertakings not owning generating stations had a lower average "grid" price than the company sample.

It thus appears that on one test of efficiency - the thermal efficiency of the plant, the company undertakings, on the whole, have the better showing, while with the other partial efficiency test, that of "selling efficiency" the opposite is true. The superior "selling efficiency" of the municipal undertakings may be due partly to more favourable supply areas (reducing distribution costs) and lower administrative costs, but the most important cause is probably the lower total outgoings or charges on the capital raised by municipal undertakings. This proposition is discussed more fully in the section on finance,[2] as well as in the general conclusions.[3]

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1. Cf. pp. 283 et seq.
2. Cf. pp. 314 et seq.
3. Cf. pp. 430 et seq.

The following Table (136) shows the movement of prices in the same sample of company and municipal undertakings as were included in the comparison in Table 133.

Table 136. Changes in prices charged for "Lighting, Heating and Cooking" by municipal and company electricity undertakings, 1938-1947.[1]

Undertaking	PRICE 1938	1939	1940	1941	1942	1947	Total change 1938-47	Change in purchase price 1938-47
	d. per unit							
A. Companies								
Midland Elec. Corp. for Power Dist.	2.14	2.06	2.07	2.11	2.16	1.56	-0.58	+0.21
Northampton	1.66	1.58	1.58	1.47	1.44	1.24	-0.42	+0.27
Boston	2.85	2.85	2.69	2.73	2.73	2.23	-0.62	+0.24
Cambridge	2.71	2.45	2.26	2.07	2.04	1.65	-1.6	0.0
Mid-Cheshire	1.76	1.78	1.75	1.61	1.58	1.22	-0.54	+0.19
Mersey	2.26	2.07	1.90	1.78	1.74	1.34	-0.92	+0.17
South London	1.60	2.00	1.80	1.80	1.90	1.60	0.0	+0.15
B. Local authorities								
Wolverhampton	1.40	1.39	1.42	1.37	1.31	1.00	-0.4	+0.24
Norwich	1.46	1.57	1.77	1.67	1.69	1.46	-0.0	+0.30
Luton	1.08	1.08	1.25	1.04	1.08	1.05	-0.03	+0.29
Spalding	2.10	1.99	1.70	1.86	1.93	1.59	-0.51	+0.24
Watford	1.06	1.02	1.02	0.98	1.07	.93	-0.13	+0.26
Lancaster	1.38	1.35	1.27	1.13	1.20	.97	-0.41	+0.35
Chester	1.45	1.40	1.54	1.53	1.48	1.25	-0.20	+0.31
Birkenhead	1.60	1.56	1.50	1.51	1.52	1.27	-0.33	+0.26
Battersea	1.36	1.31	1.29	1.80	1.91	1.59	+0.23	+0.32

Note: In each case the years referred to are the calendar year ending on 31st December for company undertakings, and the financial year, ending on 31st March of the following year from year shown, for Local authorities. Thus "1938" is the year ending 31st December, 1938, for companies, the year ending 31st March, 1939, for local authorities.

1. E.C. R.E.F.S. 1938-9 - 1942-3 and Min. of Fuel and Power R.E.F.S., 1947-8.

This Table shows that electricity undertakings have been able to reduce prices despite a considerable increase in the price which they have had to pay for energy. Each of the undertakings in this sample had to pay a higher price for its energy in 1947 than it did in 1938, but only one municipal undertaking charged a higher price in 1947. Two undertakings, one company and one municipal, charged the same price to domestic consumers in 1938 and 1947 while all the other undertakings had reduced their price in the later year. The main reason for this decrease of price has of course been the increase in total sales, making possible a decrease in total average cost of supply. The position of Battersea, the one undertaking charging more in 1947 than in 1938 can be explained by the relatively small increase in the demand for current, which is illustrated in the following comparison shown in Table 137.

Table 137. Comparison of expansion of Battersea and Luton electricity undertakings, 1938-47.

Undertaking	Total sales		No. of consumers	
	1938	1947	1938	1947
Battersea	65,998	69,174	34,436	37,144
Luton	139,356	238,431	37,977	45,764

In the following Table (138) the percentage changes of "grid" purchase price and "domestic" price charged for company and for municipal undertakings are compared.

Table 138. Percentage changes in purchase price and "domestic" selling price of energy for selected municipal and company electricity undertakings 1938-47

Undertaking	% change 1947/1938 of purchase price d. per unit	% change, 1947/1938[1] of "domestic" selling price. d. per unit
A. Companies		
Mid. Elec. Corp.	+48.8	-27.1
Northampton	+56.0	-25.3
Boston	+42.85	-21.8
Cambridge	0.0	-59.0
Mid-Cheshire	+37.3	-30.7
Mersey	+39.5	-40.7
South London	+21.4	0.0
B. Local authorities		
Wolverhampton	+64.9	-28.6
Norwich	+75.0	0.0
Luton	+80.6	-27.8
Spalding	+42.85	-24.3
Watford	+72.2	-12.3
Lancaster	+109.4	-29.7
Chester	+79.5	-13.8
Birkenhead	+56.5	-20.6
Battersea	+64.0	+16.9
Av. Co.	+35.1	-29.2
Av. l.a.	+71.7	-15.6
Av. l.a. excluding Battersea	+72.6	-19.6

1. E.C. R.E.F.S. 1938-9-42-3, Min. of Fuel & Power R.E.F.S. 1947-8.

The municipal undertakings in this sample thus had to face a much greater increase in the cost of energy than did the companies. They were able to absorb the increased cost slightly more successfully than the companies. Taking 1938 as 100 the relation of the Index figures of Cost and Selling price were - Companies - $\frac{135.1}{70.8}$ = 190.8%; Local authorities - $\frac{171.2}{84.4}$ = 203.4%.

Allowing for the differences in the structure of the two industries the general results of the comparison of efficiencies in the electricity industry may be said to be similar to those in the gas industry. The average thermal efficiency of the Selected Stations owned by company undertakings was a little higher, and the generating costs lower, than those of municipally-owned undertakings. On the other hand, the prices charged by municipal undertakings showed that they added less to the cost of purchasing the current than did company undertakings, and consequently sold current more cheaply, on the average, that did the company undertakings.

CHAPTER II

Finance

In making a comparison between the practices of local authorities and companies in financing the operation of gas and electricity undertakings there are three main questions around which the investigation centres. These are -

1. To what extent was it true that local authorities could borrow money more cheaply than could companies?
2. Apart from their possible ability to raise money more cheaply than companies, did the financial practices of local authorities result in more or less of the surplus being retained in the undertaking?
3. What is the significance, from the point of view of the consumer and of the community, of any substantial differences between municipal and company practice revealed in answering the first two questions?

The distinction between the first two questions is a real one, but does, perhaps, require a little further explanation. Local authorities may be able to borrow more cheaply than can companies because of the security of the rate fund, or in recent years, because of the artificially low rates

charged by the Public Loans Board. But they may also retain more of the surplus within the undertaking as an act of deliberate policy. This is because the local authority may not - to use the language of economic theory - seek any reward (or may be satisfied with a lower reward) for the risk bearing part of its entrepreneurial function. It has no duty, other than the fulfilment of its strict legal obligations, towards the people who lend capital to it. The joint stock company, by contrast, has to consider shareholders as well as consumers. As far as the capital provided by Ordinary shareholders is concerned the sign of success of a company is to increase, rather than reduce, the dividend payable.

Before further consideration of these questions, however, it is advisable to spend some time describing the methods by which companies and local authorities raise and repay capital. The position of local authorities may be described first. Since the chief concern here is with the finance of trading undertakings it is the pre-war methods of raising capital which are of most significance. Subsequent changes, particularly those brought about by the Local Authorities Loans Act of 1945, only had effect during the last year or two of the municipal operation of gas and electricity undertakings. Local authorities have met capital expenditure both out of revenue and by raising

loans. Revenue contributions towards capital expenditure have been made out of the surpluses earned by trading undertakings, and also, in some cases, out of special Capital Reserve or Capital Funds. These Funds were built up under powers obtained in local Acts, which usually specify the maximum amount of the Fund, and the maximum contribution which can be made from the rate Fund.

There are a number of ways in which local authorities have raised loans to meet capital expenditure. Short term commitments can be met by arranging for an overdraft at the bank. For most types of capital expenditure a more permament form of loan is necessary however. There are three main methods by which local authorities have raised longer term loans. Many authorities have raised mortgages on their rates and revenues. The type of mortgage has varied according to the method of repayment. Some mortgages are repayable by instalments over a period of years, in which case repayment may be either by the Equal Instalments of principal method, when the actual payments made diminish as the amount of interest payable on the outstanding capital decreases, or by the annuity method whereby identical repayments are made over the whole period, the amount of principal repaid increasing as the amount of interest decreases. The second method is more convenient in providing a steady outgoing over the whole period,

but entails a larger total repayment than the first method. Most mortgages are, however, repaid in a lump sum at the end of a period of years.

The other most important method of raising loans in the pre-war period was by the issue of stock to the general public. Powers to issue stock were given to all local authorities, except Metropolitan Boroughs and Parish Councils, by the Local Government Act of 1933. Previous stock issues were made under powers obtained in local acts. Only the stocks of the large authorities (boroughs with a population of more than 50,000), were given the status of trustee stock. Thus it was the larger authorities which could borrow most cheaply by this method and which made most use of their powers to issue stock.

Finally, before the war, small local authorities, with a rateable value of not more than £200,000, could borrow from the government-financed Public Works Loan Board. Where pre-war issues of stock became due for redemption the local authority could make a new issue with consent from the Treasury. Recently the right to make public issues of stock has been restored. The rates charged by the Public Works Loan Board have also been increased, thus removing the subsidy which the ability to borrow at artificially low rates from the P.W.L.B. had in fact given to local authorities in recent years.[1]

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1. See for example "Local Authority Borrowing", The Banker, Dec.1952.

The local authority can deal in two rather different ways with the repayment of those loans (whether mortgages or stock) which have to be repaid in a lump sum at the end of a period of years. The main distinction between these methods depends upon whether or not a sinking fund is built up. If the sinking fund method is adopted then a sufficient sum is set aside each year to meet (with accrued interest) the total sum borrowed when it falls due for repayment. The alternative is to pay only interest payments from revenue and to raise a fresh loan whenever an old one falls due for repayment. Any sums which could have been used to form a sinking fund are instead used for further capital expenditure. This latter procedure is now generally preferred, as it is considered unnecessary to raise loans on the one hand and invest sinking funds on the other. Good financial management is also improved by having a Loans Pool of all loans raised by the Council. Stock issues cannot be merged in such a Pool, but the Institute of Municipal Treasurers and Accountants has drawn up a model scheme for the management of a Loans Pool, including stock issues.

A company can finance its operations in three main ways, apart from 'ploughing back' profits. It may raise short term capital in the form of bank overdrafts, and it can issue shares to the public. Shares themselves fall into

two main categories - Loan Capital, bearing a fixed rate of interest, and secured by a mortgage on property and plant, but normally carrying no rights of control, and Preference and Ordinary Shares, the former with a fixed or partly fixed rate of interest, the latter having a rate of interest or dividend fluctuating according to the rate of profit. The really significant difference between the financial practices of local authorities and companies lies in the position of Ordinary shareholders and their attitude towards the repayment of borrowed capital. All loans raised by local authorities are ultimately repayable, although this may be only by the raising of another loan. The Ordinary capital of companies, on the other hand, is never repaid, and the amount of issued capital generally grows steadily with the size of a company. This means that the attitude towards the problem of the depreciation of equipment varies. A company undertaking must set aside a sum each year to cover the depreciation of its assets. Local authorities, by contrast, repay the loan covering the cost of a piece of capital equipment, within the lifetime of the asset. This means that when the asset is worn out (or probably before, if it has been repaired or partly renewed by charges on revenue) the corresponding burden of loan debt is also extinguished, and a new loan can be raised to buy any new equipment required. The criticism of local

authorities that they do not set aside sufficient reserve to meet depreciation of assets does not appear to allow for this difference between municipal and company financial practice. It is possible, however, that some local authorities have not made proper allowance for the depreciation of those assets which they have bought from revenue. The different financial structures of municipal and company undertakings may be illustrated by comparing a former municipal with a former company undertaking. The undertakings chosen for this comparision were the Borough of Darwen Gas Department (year ended 31st March 1947) and Exeter Gaslight and Coke Company (year ended 31st December 1948). The relative size of these two undertakings is shown by the following figures:-

	Gas Sold Therms	No. of Consumers	Capital Expenditure £.
Darwen	1,652,423	11,084	196,304
Exeter	4,406,049	21,412	414,325

The following figures compare the indebtedness of the two undertakings:-

Darwen	£.	s.	d.	Exeter	£.	s.	d.
Mortgage Loans	16,646.	13.	6.	Issued Capital (plus premiums)	314,159.	13.	8.
Amenities	20,452.	10.	0.	Overdraft	100,165.	7.	4.
Outstanding Debt	37,099.	3.	6.		414,325.	1.	0.

Darwen	£.	s.	d.	Exeter	£.	s.	d.
	37,099.	3.	6.		414,325.	1.	0.
Debt redeemed	145,304.	13.	5.				
Reserve Contribution	13,550.	9.	5.				
Sundry Creditors	350.	0.	0.				
Total Capital Expenditure	196,304.	6.	4.	Total Capital Expenditure	414,325.	1.	0.

These figures illustrate one of the main differences between municipal and company financial practice - that is, as already stated, that local authorities repaid the original capital raised to finance the undertaking, whereas companies did not. There are, of course, qualifications to this statement. All local authorities have not been able to make equal provision for the redemption of capital. Some companies (particularly the larger electricity companies) did raise a considerable part of their capital in the form of redeemable debenture shares. But this loan capital was generally only repaid by the raising of fresh loans, and the picture of companies with a constant or amount of capital raised contrasted with the local authority undertakings having loans outstanding gradually diminishing over the years, was generally true.

Attention may now be turned to the first of the questions asked - the degree to which local authorites could finance their trading enterprises more cheaply than

could companies. It is obvious that a fair basis of comparison must include the payments made to those providing capital in both types of enterprise. These payments are here called "total capital charges". For local authorities this is taken as including all interest payments together with any transfers made in aid of the rate fund. For companies the term covers both interest payment on loan capital and dividend paid on Preference and Ordinary Shares.

The following table shows a comparison of these "total capital charges" for 13 pairs of municipal and company electricity undertakings, each pair being of about the same size judged by the amount of capital outstanding in 1947-8. For the company undertakings the term "Capital" covers all loan and share capital raised, and includes in some cases reserves capitalised. For the municipal undertakings the figure for "Capital" refers to the nett debt of the undertaking - i.e., the total of loans out-standing less the balance of any Sinking Funds. Since separate figures of the amount of Sinking Funds are not available it is not possible to give exact figures of the actual amount of the loans on which interest was paid. This means that in some cases the figures of capital may be smaller than the amount on which interest was paid, and the interest rates somewhat higher than the true figures. The figures in the last column "Whole la. pool" show the average

interest rate paid by the local authorities on all capital entered (for all purposes) in 1947-8.[1]

Table 139. Loan charges and dividends paid by municipal and company electricity undertakings, 1947-8[2]

Undertaking	Capital	Loan charges	Rate Contribution of dividend	Total Capital Charges	Rate	Whole la. Pool
	£	£	£	£	%	
Blandford Co.	16,000	-	1,280	1,280	8.0	
Caernarvon Corp.	16,438	596	-	596	3.6	2.75
Ilfracombe Co.	50,000	-	3,000	3,000	6.0	
Dartford Corp.	48,596	511	278	789	1.6	3.19
Paignton Co.	100,000	-	4,000	4,000	4.0	
Aberystwyth Corp.	100,872	3,404	-	3,404	3.4	
Central Sussex Co.	260,000	845	13,000	13,845	5.3	
Burnley Corp.	269,352	12,847	-	12,847	4.8	3.46
Richmond Co.	310,000	-	18,600	18,600	6.0	
Brentford Corp.	300,092	9,053	-	9,053	3.0	3.47
Isle of Wight Co.	450,000	-	34,500	34,500	7.7	
Battersea Bor.	461,966	18,725	-	18,725	4.05	3.91
Cambridge Co.	530,000	2,213	35,000	37,213	7.0	
Hastings Corp.	507,405	13,372	-	13,372	2.6	2.76
West Kent Co.	1,000,000	-	72,500	72,500	7.25	
Plymouth Corp.	1,039,936	36,876	-	36,876	3.5	2.83
London Electric Supply Co.	1,573,325	1,631	94,399	96,030	6.1	
Coventry Corp.	1,697,368	60,951	-	60,951	3.6	3.38
Electrical Dist. of Yorkshire Ltd.	3,302,573	18,460	213,732	232,192	7.0	
Portsmouth Corp.	3,304,386	95,158	-	95,158	2.9	3.01
Derby and Notts. El. Power Co.	4,850,000	77,955	337,500	415,455	8.6	
Preston Corp.	4,990,658	121,887	-	121,887	2.4	2.82
Lancashire Co.	7,267,495	142,036	318,784	460,820	6.3	
Bristol Corp.	7,136,175	244,826	-	244,826	3.4	8.26

1. I.M.T.A. Return of Outstanding Debt.

2. Min.Fuel and Power R.E.P.S.1947-8 and I.M.T.A. Return of Outstanding Debt, 1948. This table, and Tables 142,145 and 146 are reproduced from my article "Public and Private Financing of Industrial Enterprise", Ec.Journal, December, 1951. See also Appendix.

Table 139.
(contd.)

Undertaking	Capital	Loan charges	Rate contribution of dividend	Total Capital charges	Rate	Whole la. Pool
	£	£	£	£	%	
London Power Co.	14,423,582	670,989	3,000	673,989	4.7	
Birmingham Corp.	13,806,159	475,736		475,736	3.4	3.09
Average - Companies					6.46	
Average - Local authorities					3,25	3.16

Municipal undertakings underlined.

Table 140 shows a comparison of the total capital charges for these same pairs of undertakings for the earlier years 1938 and 1942.

[Page No. 325 omitted by typist].

Table 140. 'Total capital charges' of pairs of municipal and 1938 and 1942.'

Undertaking.	Capital		Loan charges	
	1938.	1942	1938	1942
Blandford	16,000	16,000	-	-
Caernarvon	45,640	29,869	1,173	1,128
Ilfracombe	50,000	50,000	-	-
Dartford	89,545	47,105	2,452	1,778
Paignton	100,000	100,000	8	-
Aberystwyth	118,565	114,153	3,196	4,139
Central Sussex	260,000	260,000	-	375
Burnley	347,033	373,372	16,039	15,722
Richmond	310,000	310,000	1,215	-
Brentford	389,939	356,046	12,471	13,524
Isle of Wight	450,000	450,000	1,969	-
Battersea	887,504	725,009	39,003	34,048
Cambridge	530,000	530,000	1,973	2,104
Hastings	701,792	572,864	33,504	27,196
West Kent	500,000	1,000,000	646	-
Plymouth	972,420	1,229,618	33,251	47,680
London Electric	1,573,325	1,573,325	1,832	2,267
Coventry	1,921,641	1,848,988	59,745	67,456
El.Dist.of Yorkshire	3,200,000	3,283,333	14,305	17,602
Portsmouth	1,975,165	2,045,649	79,667	79,982
Derby & Notts.	3,871,250	4,348,900	59,604	56,524
Preston	1,855,244	2,609,006	56,119	65,777
Lancashire	6,280,955	6,275,292	136,542	106,354
Bristol	5,860,405	6,138,657	249,454	241,229
London Power	18,511,636	17,947,111	841,756	727,119
Birmingham	11,331,319	12,220,616	461,619	471,034

1. E.C. -R.E.F.S. 1938 and 1942.

company electricity undertakings,

Rate cont. or dividend.		'Total capital charges	
1938.	1942	1938	1942
1,280	1,280	1,280	1,280
-	-	1,173	1,128
4,667	3,500	4,667	3,500
-	900	2,452	2,678
10,000	10,000	10,008	10,000
-	-	3,196	4,139
9,778	11,700	9,778	12,075
4,600	-	20,639	15,722
21,700	18,600	22,915	18,600
-	-	12,471	13,524
34,500	34,500	36,469	34,500
-	-	39,003	34,048
35,000	35,000	36,973	37,104
3,000	-	38,504	27,196
40,000	62,500	40,646	62,500
-	-	33,251	47,680
111,882	68,176	120,714	70,443
-	-	59,745	67,456
207,000	209,500	221,305	227,102
27,500	-	107,167	79,982
240,000	272,000	299,604	328,524
-	-	56,119	65,777
277,068	317,250	413,610	423,604
-	-	249,454	241,229
3,000	3,000	844,756	730,119
-	-	461,619	471,034

Table 141 shows these total capital charges as percentages of the total capital in 1938 and 1942 respectively.

Table 141. 'Total capital charges' as percentages of capital employed, 1938 and 1942[1]

Undertaking	Total capital charges - rate %	
	1938	1942
Blandford	8.0	8.0
Caernarvon	2.6	3.8
Ilfracombe	9.3	7.0
Deptford	2.7	5.7
Paignton	10.0	10.0
Aberystwyth	2.7	3.6
Central Sussex	3.8	4.6
Burnley	5.9	4.2
Richmond	7.4	9.4
Brentford	3.2	3.8
Isle of Wight	8.1	7.7
Battersea	4.4	4.7
Cambridge	7.0	7.0
Hastings	5.5	4.7
West Kent	8.1	6.2
Plymouth	3.4	3.9
London Electric	7.7	4.5
Coventry	3.1	3.6
Elect. Dist. Yorks.	6.9	6.9
Portsmouth	5.4	3.9
Derby & Notts.	7.7	7.5
Preston	3.0	2.5
Lancashire	6.6	6.7
Bristol	4.3	3.9
London Power	4.6	4.6
Birmingham	4.1	3.8
Averages - total	5.59	5.47
- Companies	7.3	6.9
- Local authorities	4.0	3.9

1. Calculated from E.C. R.E.F.S., 1938 and 1942.

Table 142 shows a comparison of the 'total capital charges' of random samples of 33 municipal and 33 company undertakings, in 1948-8.

Table 142. 'Total capital charges' of random samples of municipal and company electricity undertakings, 1947-8[1]

Sample	Loan charges	Rate Fund or Dividends	Total Capital Charges	Capital	Rate % of capital charges
	£	£	£	£	%
33 company undertakings	72,821	653,182	7236,003	11,456,637	6.3
33 municipal undertakings	329.563	246,673	354,236	10,405,589	3.4

Table 143 shows a summary of these figures comparing the 'total capital charges' of municipal and company electricity undertakings.

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1. Ministry of Fuel and Power, R.E.F.S., 1947-8.

Table 143. Summary of comparison of 'total capital charges' of company and municipal electricity undertakings

Sample and Year	Average rate of total capital charges		Amount by which average of municipal undertakings lower
	Co. %	L.a. %	
13 'pairs' 1938	7.3	4.0	3.3
13 'pairs' 1942	6.9	3.9	3.0
13 'pairs' 1947	6.46	3.25	3.21
33 random undertakings, 1947	6.3	3.4	2.9

The evidence of these tables clearly establishes the fact that the 'total capital charges' of municipal undertakings was considerably lower than that of company undertakings. The total outgoings of the municipal undertakings was about 3 (%) less than that of these owned by companies. There appeared to be little difference in this relationship at different times in the period 1938-47. The advantage of the municipal undertakings in this respect was less noticeable with some of the larger undertakings. This may have been partly because of the ability of the larger and better known companies to borrow more cheaply, but was also

a reflection of the tendency of some of the larger companies to have a larger proportion of their total capital in the form of fixed interest debenture or preference shares.

Table 144 shows the same comparison for samples of municipal and company gas undertakings.[1]

Table 144. Total capital charges of company and municipal gas undertakings

Sample	Total capital charges %
20 company undertakings	6.09
20 municipal undertakings	3.306

These figures show a similar relationship to that existing between municipal and company electricity undertakings.

It is apparent that this comparison of 'total capital charges' calculated as a percentage of the amount of capital outstanding, do not tell the whole story. This is because the total of outstanding debt may not bear a constant relationship to the actual size of undertakings. Leaving Aside for the moment the problem of whether the undertaking

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1. Calculated from B.o.T. Returns 1937 (Pt.II).

owned any generating plant, the amount of outstanding debt (using this term to include the Ordinary capital of joint stock companies as well as loan capital) would vary according to the policy of the concern in repaying debt and 'ploughing back' profits over the years. It should therefore be useful to compare company and municipal undertakings on a basis of the relationship of 'total capital charges' to size rather than to outstanding debt. One measure of size which may be adopted is that of the total annual sales of current.

The figures above show only the relation of total interest payments to outstanding capital, and do not necessarily reflect the relationshop between the size of the undertaking as measured by its sale of energy and 'total capital charges'. This is because the amount of capital outstanding does not always vary directly with the sales of the undertaking. Some undertakings owned generating stations, which would obviously make their capital needs greater than those of undertakings concerned only with distribution. With most company undertakings some capital expenditure has been made out of revenue surplus 'ploughed back' into the concern. The local authorities have also made some capital payments out of revenue, and more important, have often repaid a considerable amount of the

loans raised, so that the outstanding loans do not reflect the actual size of the undertaking. It is therefore useful to make a comparison between the total capital costs and the electricity sold by company and municipal undertakings. Generating stations owning undertakings cannot be conveniently compared even with each other on this basis of total sales and total capital costs, since the size of the generating station and the sales do not necessarily vary together. Undertaking "A" may have smaller total sales than undertaking "B", but own a larger power station which exported part of its output over the grid system. The following comparisons are therefore confined to undertakings which did not own generating stations of their own in 1938-9. The relationship of "total capital charges" to units sold is not, of course, a completely satisfactory way of measuring the relative cost of borrowing capital by municipal and company undertakings. This is because the capital cost of the distribution system will not always vary with the size of sales. Some will have higher sales per consumer, or a more favourable ration of consumers per mile of mains and consequent lower capital costs in relation to the units sold. This makes individual comparisons possibly misleading, but in the following comparisons between ten companies and

~~XXX~~ ten municipal undertakings (Table 145) there is no reason to suppose that either the municipalities or the companies are more favourably placed as a group in these respects. A comparison between 1948-8 and 1938-9 is given in each case for two reasons. Firstly it is possible to check whether either group has increased its sales more proportionately than the other - a factor which would tend to give it lower capital charges per unit sold since these costs are likely to increase more slowly than sales once the main distribution system is completed. Secondly, the year 1947-8, as the last year of independent operation before nationalisation, was to some extent abnormal, since some undertakings appear to have departed from normal practice in keeping prices artificially low, or in paying unusual sums in aid of rates in this period. This latter factor would of course inflate "total capital charges".

Table 145. Comparison of sales and "total capital charges" of electricity undertakings, not being owners of gen having sales exceeding 30,000,000 units in 1947-8

Undertaking	Units sold		Loan charges		Rate-divid
Companies	1947	1938	1947	1938	1947
Bournemouth	156,624	66,599	16,160	14,926	108,012
Central Sussex	46,583	23,386	845	-	13,000
Chesham	30,032	12,118	699	330	9,636
Colne Valley	83,884	37,771	608	1,527	27,600
Egham	89,294	33,705	1,312	486	51,614
Electrical distribution of Yorkshire	150,394	60,709	18,460	14,305	213,732
Electrical distribution of N.Wales	57,965	18,791	12,425	13,625	115,691
London Electric Supply	368,082	384,556	1,631	1,832	94,399
Metropolitan Electric Supply	826,430	479,755	92,678	57,276	292,500
Mid-Cheshire	56,847	17,845	3,749	8,609	59,066
TOTALS	1,866,135	1,135,235	148,567	112,916	985,250
Local authorities					
Aylesbury	54,444	25,417	6,440	7,654	2,590
Birkenhead	199,819	127,223	29,660	30,658	16,500
Bermondsey	33,786	31,211	6,043	15,684	-
Cannock	34,108	15,537	3,926	7,521	2,294
Cheltenham	43,562	16,121	5,938	6,585	-
Chichester	48,919	21,970	9,819	8,385	4,200
Clitheroe	36,264	23,871	3,165	3,746	1,401
Ealing	42,977	27,438	7,869	18,304	-
East Ham	46,257	34,037	6,927	13,613	16,248
Wolverhampton	291,028	178,636	21,516	34,888	10,776
TOTALS	831,164	501,461	101,303	147,038	54,009

1. Ministry of Fuel and Power - R.E.F.S. 1947-8, and E.C.,

municipal and company erating stations, and

aid or nds 1938	Total capital charges 1947	1938
126,656	124,172	141,582
9,778	13,845	9,778
21,723	10,335	22,053
17,690	28,208	19,217
74,974	52,926	75,460
207,000	232,192	221,305
25,441	128,116	39,066
111,882	96,030	113,714
382,500	385,178	439,776
39,821	62,815	48,430
1017,465	1,133,817	1,130,381
2,173	9,030	9,827
12,308	46,160	42,966
-	6,043	15,684
-	6,220	7,521
2,500	5,938	9,085
-	14,019	8,385
500	4,566	4,246
-	7,869	18,304
5,289	23,175	18,902
12,521	32,292	47,409
35,291	155,312	182,329

R.E.F.S. 1938-9 - 1942-3.

This Table shows that both municipal and company undertakings were able to expand their sales considerably between 1938 and 1947 without any corresponding increase in "total capital charges". The percentage increase of sales for the sample of company undertakings was 64.4 while "total capital charges" increased by only .3%. The municipal undertakings increased their sales by 39.7% while their "total capital charges" decreased by 14.8% on the 1938-9 figure. The municipal undertakings paid more in aid of rates in 1947-8 than in 1938-9, but reduced loan charges very considerably. The increase in payments in aid of rates may be partly explained, as mentioned above, by the fact that 1947-8 was the last year of independent operation before nationalisation, and some local authorities seem to have been tempted to make the most of their last opportunity to relieve the rates by transfers from electricity profits. The relationship of "total capital charges" to units sold for the above undertakings is shown in more concise manner in the following Table (146).

Table 146. "Total capital charges" per thousand units of energy sold for samples of municipal and company electricity undertakings 1938-9 and 1947-8[1]

Sample	"Total capital charges" 1938-9	1947-8
10 companies	19s. 10.97d.	12. 1.82d.
10 loc.author.	7s. 3.26d.	3s. 8.85d.

1. Min. of F.& P., R.E.F.S. 1947-8 and E.C. R.E.F.S. 1938-9-42-3.

Thus the advantage of the municipal undertakings in respect to "total capital charges" is greater when this is measured in relation to the total units sold than in relation to the total capital raised. Another criterion of size which may be adopted, and for which comparable figures are available for electricity undertakings, is that of the total of expenditure charged to capital account. In the next Table the relationship of "total capital charges" to total capital expenditure are shown for two samples of municipal and company electricity undertakings.

Table 147. "Total capital charges" and total expenditure of municipal and company electricity undertakings[1]

Sample	"Total capital charges" as % of total expenditure	
	%	
	1938	1943
10 companies, exporting more than £ 1m.	5.09	4.17
10 l.a. exporting more than £ 1m.	2.12	1.85
10 companies exporting less than £ 1m.	5.63	3.03
10 l.a. exporting less than £ 1.m.	2.17	1.82

1. Calculated from E.C., R.E.F.S. 1938 and 1943.

These figures thus support the conclusion already formed on the evidence of the sales-capital charges comparison, that the advantage of the municipal undertakings in relation to the level of "total capital charges" was even greater in relation to the size of the undertakings than when the basis of comparison was outstanding capital or debt. This of itself does not necessarily mean that the answer to our second question is that municipal undertakings did retain more of the surpluses which they made than did those owned by companies. Although it is evident that municipal undertakings have generally reduced the amount of outstanding loans steadily over the years, while the outstanding capital of companies has remained the same or increased, this does not prove that local authorities have "ploughed back" more of the revenue surpluses into the undertakings than have the companies. Instead of repaying capital the companies could have built up bigger reserve funds or made more generous allowances for depreciation than the municipal undertakings. Separate figures of the reserve funds of gas and electricity undertakings are not available on a comparable basis, but the Ministry of Fuel and Power Returns relating to electricity undertakings do show the amount of revenue not earned from sales of current, which covers mainly the income from investments.

It seems reasonable to assume therefore, that the amount of this "other revenue" should vary with the size of the reserve fund built up by an undertaking. Table 148 shows the size of this other income for samples of municipal and company electricity undertakings, in relation to the amount of current sold.

Table 148. "Other income" of electricity undertakings in relation to current sold[1]

Sample	"Other income" per 100,000 units of energy sold
	£
30 company undertakings, 1939	6.0941
30 municipal undertakings, 1939	12.9376
30 company undertakings, 1947	10.5788
30 municipal undertakings, 1947	13.1837

Both in 1939 and 1947 the average income resulting mainly from income on reserve funds and investments was higher, in relation to the energy sold, for municipal undertakings than for those owned by companies. Table 149 shows the relationship of the total of provisions for depreciation and transfers to sinking funds for samples of municipal and company electricity undertakings to sales of energy.

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1. Calculated from E.C., R.E.F.S. 1939 and Min. F.& P. R.E.F.S. 1947.

Table 149. Depreciation allowances plus transfers to sinking funds per 100,000 units of energy sold for samples of municipal and company electricity undertakings, 1938[1]

Sample	Depreciation allowances + transfers to sinking funds per 100,000 units of energy sold
	£
10 company undertakings owning Selected stations	128.137
10 municipal undertakings owning Selected stations	110.575
10 company undertakings not owning generating stations	164.623
10 municipal undertakings not owning generating stations	162.268

The evidence of these smaller samples is thus that when depreciation allowances were taken into account, the companies were providing more under these two headings in relation to sales of energy, than were the municipally owned undertakings.

The evidence of these last two Tables tends to support the conclusion that company undertakings may have transferred more of their surplus direct to depreciation funds but that

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1. Calculated from E.C., R.E.F.D. 1939, and Min. F.& P. R.E.F.S. 1947.

municipal undertakings may have, in effect, done the same by building up larger reserve funds or by making a bigger allowance for the redemption of outstanding debt. This measurement in relation to energy sold is not, however, particularly satisfactory. The total of capital expenditure will vary with the date of the undertaking and the degree of mechanisation, as well as with size as measured by sales of energy. A more complete comparison can be based upon the disposal of the gross surplus of company and municipal undertakings. For the purposes of this comparison the gross surplus is taken as being the surplus of income over expenditure when all operating costs have been met, and income tax paid, but before the payment of any loan charges. This differs from the normal accountant's concept of gross surplus in deducting income tax payments, but this is necessary in this comparison, as these payments are compulsory and differences in their level do not reflect any difference in the financial practices of companies and local authorities. Tables 150/5 show the figures for the amount of gross surplus distributed by the undertakings for samples of municipal and company electricity undertakings in 1938. The part of the surplus which is counted as being distributed is that paid as dividends, loan charges, or in relief of rate funds (i.e. the equivalent

of the "total capital charges" already defined above[1]). The part of the surplus retained in the undertaking is taken as the total of depreciation allowances, transfers to reserve funds, revenue contributions to capital, and transfers to sinkingfunds and debt repayments. Two of these items, revenue contributions to capital, and debt repayments are not, of course, literally retained in the undertaking, but they do help to improve its financial position, either by increasing the amount of physical capital, or by reducing the burden of outstanding debt, in a way in which payments to share- or bondholders, or in relief of rates, do not.

Table 150. Disposal of gross surplus, sample of ten company electricity undertakings, 1938 [2]

Sample	% of gross surplus paid out	
	Unweighted average	Weighted average
Companies	52.8	56.15
Local authorities	29.7	32.56

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1. Cf. p. 322.

2. E.C., R.E.F.S. 1938.

Table 151. Disposal of gross surplus, all public and private undertakings in Great Britain[1]

Ownership	% of gross surplus paid out (weighted average)				
Company	1938	1939	1940	1941	1942
Company	56.67	56.43	52.08	50.75	50.52
Local authorities	32.96	33.82	33.17	30.52	32.18

These figures show quite definitely that the amount of gross surplus distributed to those providing the capital (whether in the form of Ordinary or Loan capital) by company undertakings was considerably larger for company undertakings than it was for those owned by local authorities. The figures for an abnormal year, 1947, when nationalisation was imminent, show that this position could readily be changed by municipal undertakings when they so wished. These figures are shown in Table 152.

Table 152. Disposal of gross surplus, company municipal electricity undertakings, 1947[2]

Sample	% of gross surplus paid out	
	Weighted	Unweighted
All companies	46.97	
All l.a.	37.1	
10 companies	46.3	39.3
10 l.a.	43.4	41.2

1. E.C., R.E.F.S, 1938, 1939, 1940, 1941, & 1942.

2. Min. F.& P., R.E.F.S. 1947.

These 1947 figures show that local authorities, stimulated by the proposals for the nationalisation of the electricity industry, with compensation paid to the owners of municipal undertakings based on the amount of outstanding loan debt, paid much larger sums in relief of rates, and in many cases reduced the size of reserve funds.

There is still one point which must be investigated before the unqualified statement can be made that the average "total capital charges" of municipal gas and electricity undertakings were lower than those of company undertakings. The figures for municipal undertakings are in one sense incomplete, since they do not show any transfers from rate funds to meet working expenses or loan charges where revenue or reserves were insufficient. If this burden was considerable, it would mean that, although it would be true to say that the "total capital charges" of municipal undertakings were lower, this would be at the expense of the ratepayers. The following investigation deals only with electricity undertakings, but what figures are available indicate that the position of gas undertakings was very similar. It shows the occasions on which undertakings made a loss which entailed reduction or suspension of divident or loan payments, or in the case of municipal

undertakings, the making of transfers from the rate fund.

In recent years there are very few cases in which municipal electricity undertakings have found it necessary to draw on the rate fund to make good deficits. The following list (Table 153) shows all the cases occurring in the period 1938-9 - 1942-3 and 1947-8.

Table 153. Municipal electricity undertakings drawing on the rate fund to meet deficits, 1938-9 - 1942-3 and 1947-8[1]

Undertaking	Deficit - years and amounts	
	Year (ended 31st March)	Amount £
Bexhill	(1942	13.515
"	(1943	10.501
Clacton	(1941	7,380
"	(1942	6,342
"	(1943	9,182
Cwmbran	(1939	966
"	(1940	841
"	(1941	936
Faversham	1948	537
Gellygaer	1940	330
Leyton	1948	76
Llanfairfechan	1940	101
Middleton	1948	1,100

[continued overleaf]

1. E.C., R.E.F.S. 1938-9 - 42-3, and Ministry of Fuel and Power R.E.F.S. 1947-8.

[continued from preceding page]

Undertaking	Year	Amount £
New Mills	(1942	662
"	(1943	609
"	(1948	403
Poplar	(1942	69,199
"	(1943	69,068
Reigate	1939	1,216
Southend	(1942	13,240
"	(1943	58,215
Southwark	(1943	14,324
"	(1948	7,682
Stepney	1943	54,691
Stoke Newington	1943	10,223
Thurrock	(1939	2,594
"	(1940	3,118
"	(1941	1,881
"	(1942	1,228
"	1943	1,345
Turton	(1942	995
"	(1943	1,346
Woolwich	1948	11,391

The reasons for some of these deficits seem clear. In the case of Bexhill, Clacton, Poplar and Southend and Stepney undertakings there was a considerable fall in sales, presumably caused by evacuation. The figures for Stepney, were, for example:-

	1939	1943[1]
Total sales, thousand units	111,465	71,921
Number of consumers	44,180	28,488

In other cases the deficit was probably caused by an error in pricing. Llanfairfechan's small deficit in 1940 followed a reduction in domestic price, and the price was raised again in 1941. Reigate's 1939 deficit disappeared after a price increase. The fluctuations in the domestic price charged by the New Mills Undertaking suggest difficulty in finding a satisfactory relationship between price and cost of supply. The domestic prices (lighting, heating and cooking) charged were:

Price d. per unit	Year[2]
1.87	1939 (including power)
3.01	1940
3.06	1941
1.99	1942
2.07	1943
1.57	1948

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1. E.C., R.E.F.S. 1938-9 - 1942-3 and Ministry of Fuel and Power, R.E.F.S. 1947-8.

2. Ibid.

The Stoke Newington undertaking suffered some diminution in demand between 1939 and 1943 so that working expenses increased while revenue remained almost constant. in 1942 and previous years the gross surplus was not sufficient to cover both interest payments and transfers to Sinking Funds and Repayment of Loans, but no drawing on the rate fund was necessary as the balance on net revenue account was decreased. In 1943, however, with a slightly improved gross surplus, £ 27,514 (the entire balance in hand) was transferred from the depreciations, Renewals and Reserves Funds, there was a rate subsidy of £ 10,223, and the Balance on Net Revenue Account was increased by £ 28,036 which just covered outstanding deficit. Thus this rate subsidy was to meet an accumulated deficit caused by a war-time fall in demand. Woolwich was unique in making a substantial deficit in 1938 despite an increase in sales over the 1939-43 period. The 1948 gross surplus was larger than that of 1943, but in the former year the Balance on Net Revenue account was decreased by £ 27,272 while in 1948 it remained constant.[1]

Evidence of the reluctance of municipal undertakings to increase prices in 1948, presumably because of the

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1. E.C., R.E.F.S. 1938-9 - 1942-3, and Ministry of Fuel and Power, R.E.F.S. 1947-8.

approach of nationalisation, even when the current price was obviously too low, is given by the number of undertakings whose revenue did not even cover working expenses during this year. The following undertakings had a deficit on working expenses in 1948:-
Aberdare, Ashton-under-Lyne, Barnes, Bedwas and Machen, Bedwellty, Bridlington, Buxton, Canterbury, Cardiff R.D.C., Crewe, East Dereham, Ebbw Vale, Exeter, Collygaer, Gillingham, Hampstead, Hobden Reyd, Horsham, Leek, Marlborough, Menai Bridge, Mountain Ash, Skelton and Brotton, Tunbridge Wells, Ulverston, Willesden.[1]

In the whole of the period 1939-43 only one undertaking, Barnolswick U.D.C. managed to achieve a deficit on working (in 1943). Some of these undertakings, by means of raiding Reserve and other Funds, actually made contributions in aid of rates, even although their revenue did not cover working expenses. Aberdare, for example, had a deficit of £ 16,000 on the working account and transferred £ 450 in aid of rates.[2]

Four undertakings went to the extreme of generosity in 1947-8 by selling part of the energy which they purchased at less than the price which they had to pay for it. These

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1. Ministry of Fuel and Power, R.E.F.S. 1947.
2. Ibid.

are shown in Table 154.

Table 154. Undertakings with "power" selling price less that "grid" purchasing price[1]

Undertaking	Buying price for energy	Selling price, power
	d. per unit	d. per unit
Ebbw Vale	.66	.65
Hampstead	.93	.77
Tunbridge Wells	.86	.83
Ulverston	1.09	.52

An example of the attitude of some local authorities is provided by Rhyl U.D.C. which proposed to transfer £ 15, 071 from the electricity undertaking to the general rate fund. This sum represented the total payments from the rate fund to the electricity undertaking since its inception in 1901.[2]

It is difficult to compare the number of company owned electricity undertakings making a loss with the figures for municipal undertakings owing to the different methods of finance. Company undertakings having raised most of their funds as share capital could reduce dividends in a bad

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1. Ministry of Fuel and Power, R.E.S.F. 1947.
2. Municipal Journal, 23. V. 48.

year, without showing any signs of an actual deficit. Municipal undertakings, on the other hand, having fixed loan charges to be met, were less able to adapt their financial structure to a decreased surplus. Thus it would not be an adequate basis of comparison to compare the number of municipal undertakings having to draw on the rate fund for a subsidy with those companies which paid no dividends at all. Some account of the fluctuations of company dividends must also be taken. The actual financial position of a number of company undertakings cannot be determined accurately owing to the merging of the accounts with those of other activities (besides electricity supply) of the same or of a holding company.

The clear causes of companies which passed over dividends altogether in the period 1938-42, and 1947 are shown in Table 155.

Table 155. Electricity companies "passing" dividends 1938-42 and 1947

Undertaking	Years in which Ordinary Dividend passed over[1]
Askrigg and Reeth Co.	1938-42, 1947
Bedford, Cambridge and Huntingdon Co.	1938-41
Borth and Ynyslas Co.	1938, 1941-2
Burnham Co.	1942
Cark Co.	1938, 1940-41
Chipping Norton Co.	1938-42
Craven Hydro-Electric Co.	1938-42, 1947
Bownton Co.	1938-42
Folkestone Co.	1940-42
Frinton-on-Sea Co.	1940-42
Horley Co.	1938
Isle of Thanet Co.	1940-42
Monmouth Co.	1938-42
Notting Hill Co.	1939-42
Peacehaven Co.	1938-42, 1947
Ramsgate Co.	1940-42
Sedbergh Co.	1938-39
Tadcaster Co.	1941-2, 1947
Thornbury Co.	1938-42, 1947
Wisbech Co.	1939-42, 1947
Woodstock Co.	1938-39
Bude Co.	1942, 1947
Chudleigh Co.	1938, 1947
Holsworthy Co.	1947
Mid-Cumberland Co.	1947
North Lincolnshire Co.	1947
Ormskirk Co.	1947
Penrith Co.	1947
Ringmer Co.	1947
Settle Co.	1947
Welwyn Garden City Co.	1947
West Devon Co.	1947

1. E.C. R.E.F.S. & MIN.FUEL & POWER R.E.F.S.-1947-8.

These undertakings may be classified into three main groups according to the apparent reasons for the inability to make a distributable surplus. Firstly, as with the municipal undertakings needing rate subsidies, some suffered through war conditions and a reduction in demand for current. Folkestone, Frinto-on-Sea, the Isle of Thanet, Notting Hill and Ramsgate Cos. fall into this category. Secondly, there were a small number of undertakings which were chronically unable to make a profit, presumably through the "uneconomic" nature of the supply area. This group includes Askrigg, Borth, Cark, Chipping Norton, Craven, Bownton, Monmouth, Peacehaven, Thornbury, Wisbech, Bude and Chudleigh. The remaining undertakings showed an inability to pay dividends in one or more years for reasons which are not wholly clear from their accounts. Tadcaster was unable to pay any dividend in 1941-2 after paying 44.4% in 1938-40 after a reduction in the selling price of energy. The North Lincolnshire Co. had a larger gross surplus in 1947 than in any of the previous years during which dividends were paid, but for some reason this was used to increase the size of the Balance on Revenue Account instead of being distributed to shareholders. The Ormskirk undertaking with reduced prices in 1947 was not able to increase its revenue in the same proportion as the increase in working

expenses. The same applies to Welwyn Garden City undertaking. No company, during the period under examination, had a deficit on working alone.

Apart from those companies which passed dividends altogether many undertakings showed very considerable fluctuations in the dividends which they paid. Some examples are given in Table 156.

Table 156. Electricity companies showing considerable fluctuations in dividends paid, 1938-42 & 1947[1]

Undertaking	Year	Ordinary share dividend %
Electricity Distribution of North Wales	1938	6.36
	1939	7.74
	1940	11.76
	1941	20.49
	1942	23.40
	1947	29.00
Pontypool Co.	1938	13.79
	1939	15.37
	1940	17.39
	1941	27.00
	1942	25.00
	1947	54.50
Welwyn Garden City Co.	1938	6.9
	1939	9.0
	1940	25.4
	1941	20.0
	1942	45.0
	1947	0.0

1. E.C., R.E.F.S. 1938-9 - 1942-3 and Min. Fuel & Power, R.E.F.S. 1947-8.

Generally the larger companies had a much more steady rate of dividends than this, however, e.g. North-Eastern Electric Supply Co. paid 7% throughout 1938-42 and in 1947.

The above facts about the financial position of company and municipal electricity undertakings are summarised in the following Table (157).

Table 157. Municipal and company electricity undertakings drawing on the rate funds, showing a deficit on working account, or "passing" dividends, 1938-9 - 1942-3, 1947-8[1]

Total no. of undertakings in 1942-3	Rate Fund Drawings		Deficits		Ordinary Dividends "Passed"	
	No.	Occasions	No.	Occasions	No.	Occasions
Companies 183	--	--	--	--	32	92
Local authorities 335	18	33	27	27	--	--

Thus during the six sample years, out of 183 company undertakings (existing in 1938) 32 passed dividends on Ordinary Shares on 92 occasions. Of the 335 undertakings owned by local authorities in 1938-9, 18 drew on the rate fund on 33 occasions, and 27 had a deficit on working account

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1. E.C., R.E.F.S. 1938-9 - 1942-3 and Min. Fuel & Power R.E.F.S. 1947-8.

on 27 occasions during the same six years. (In no case was there any overlap between the municipal undertakings having a deficit on working account and those drawing on the rate fund. The deficits on working account were, with one exception, a phenomenon of the year preceding nationalisation, and the subsequent deficits were met by drawing on reserve funds.) As has already been pointed out, it is difficult to find a common basis for comparison of the tendency to make losses of municipal and company electricity undertakings. To compare the occasions on which the gross surplus for companies was insufficient to pay any Ordinary dividend with those on which municipal undertakings had a gross surplus less than the amount of sinking fund and loan charge payments means a bias in favour of the companies since the local authorities could not reduce their loan payments while dividends were variable. On the other hand a comparison of the number of occasions on which companies passed dividends with the number of drawings on rate funds might favour local authorities since they seem to have been more ready to draw on reserves to meet deficiencies. With this qualification on the strict comparability of municipal and company financial results, some conclusions, or tendencies can be pointed to.

Under the economic conditions of recent years, the

great majority of electricity undertakings have found no difficulty in making a net surplus. Where this has not been the case, the most important reason, for both company and municipal undertakings, has been the fall in the demand for current in some areas caused by war time circumstances.

Other undertakings have failed to achieve a surplus on some occasions through mistakes in pricing policy.

A few small company undertakings appear to have been consistently unable to achieve a surplus.

The experience of the last working year before nationalisation was exceptional. A number of municipal undertakings incurred losses on the working account by what must have been to some extent, deliberate policy.

In so far as their records are comparable, municipal undertakings were at least as successful as the companies in avoiding a net deficit. The actual burden falling on rate funds as a result of their 'bearing the risk' of enterprise, and having to make good payments on loans when the gross surplus was insufficient to cover these, was very small.

The general result of the investigation is to show that public and private ownership of the gas and electricity industries did result in quite distinct patterns of financial organisation. The differences

centred around two main points. Firstly, the 'total capital charges' of the municipally owned undertakings were considerably lower. There were two distinct reasons for this. The local authorities could borrow more cheaply, on the average, than could companies, because of the security afforded by the rate fund. This advantage tended to vary inversely with the size of the company undertaking and was not important where the larger company undertakings were concerned. Apart from its ability to borrow more cheaply, the average municipal undertaking reduced 'total capital charges' by distributing less of the net surplus than company undertakings. Transfers to rate funds were less than the difference between the rate at which companies could have raised loan capital and the actual dividends paid to the owners of Ordinary shares. This relationship remained true even when allowance was made for drawings on the rate fund to meet losses.

The second major difference between municipal and company financial practice was more technical, and related to the use made of the gross surplus (apart from the amount distributed as 'profits' - a word which can here be taken to mean the surplus remaining after the minimum necessary payments to obtain working capital had been made). The most important point here was the existence

of different methods of allowing for depreciation. The municipal practice of repaying outstanding loans made it easy to confuse provision for depreciation, and the establishment of sinking funds. Part of the repayment of loans by municipal undertakings was in fact a method of dealing with depreciation. The charge that local authorities did not make proper allowance for depreciation, sometimes used to explain their ability to charge lower prices, does not appear to have any foundation.

The results of these different forms of public and private methods of financing enterprise are discussed in the broader framework of the national economy, in the final conclusions.

CHAPTER III

Location

The exact meaning of the word 'location' in relation to the gas and electricity industries is not always clear. This is because there is not such a clear division between manufacture and distribution as there is in most industries. The same undertakings were responsible both for manufacture or generation, and for the distribution to the homes of consumers. This means, for example, that statistics showing the degree of localisation of these industries can be misleading, because they are usually based on the figures of the total number of workers employed. It is as though those working in tobacconists' shops were included in the figures of those employed in the tobacco industry used as a basis for calculations of its degree of localisation. Thus Professor Sargant Florence's Coefficient of Localization shows that the electricity industry, with a figure of .14 is more widely dispersed than the gas industry with a figure of .23. But this Coefficient is based on the following formula - "When workers are divided region by region as percentages of

the total in all regions, the coefficient is the sum (divided by 100) of the plus deviation of the regional percentage of workers in the specific industry from the corresponding regional percentage of workers in all industry." For comparison, a very highly concentrated industry like jute had a coefficient of .91. For the purposes of this study location is taken as meaning the location of manufacture or generation, rather than that of all sections of the industry.

There are two main questions which can be raised about the effects of public and private ownership on the location of the gas and electricity industries. Firstly it may be asked whether the type of ownership had any effect on the degree of concentration. Is there any evidence that either public or private ownership was more successful in concentrating production in works of optimum size?

Secondly, the effect of ownership on the choice of sites for building gas and electricity works might be considered. It would be very interesting to know whether either companies or local authorities were more successful in choosing sites which were the best available for manufacture when all relevant factors were considered.

A consideration of the relationship between the type of ownership and location soon reveals the fact

that a definite answer cannot be expected to either of these questions. There are a number of reasons for this. The location of many gas and electricity works has been determined by what is little more than historical accident. Works have developed on their original sites which were chosen in the first place with little if any consideration of the economic advantages of the site. Any comparison between municipal and company location policy is made difficult by the fact that a considerable number of municipal undertakings were first started by companies and later purchased by a local authority. On the other hand it has always been open to a progressive undertaking to abandon an unsuitable site and build a new works elsewhere. In the electricity industry individual undertakings had little freedom of choice in determining location policy after the setting up of the Central Electricity Board in 1926. The difficulties of comparison are also considerable, since the circumstances and choices open to individual undertakings vary so considerably. A comparison of the results on location policy of, for example, the company owned gas undertakings of London with those of municipal ownership in Birmingham would be very difficult, because the situation in London, where the advantages of large works situated on the banks of the Thames are very obvious, is quite distinct. When all these problems have been faced then, it is obvious

that a comparison between the results of municipal and company ownership on location must be restricted to a few general points. In fact the most important problem relating to location has been the inability of either local authorities or companies to deal with this problem adequately because of their restricted and often irrational supply areas. Some attention is therefore given to a comparison of the actual pattern of location which grew up under the local authority - company system of ownership which existed before nationalisation with what might be considered to be an 'ideal' distribution of these two industries.

Before considering the industries separately some general principles which should determine an 'ideal' location policy, and which are common to both industries may be laid down. These are:-

1. Availability of the raw materials. Both industries are dependent on supplies of coal, and works must therefore be situated near to the most convenient and cheapest transport route. The electricity industry also needs large quantities of water, both for the boilers, and if possible, for cooling. Electricity generating stations built by a river do not need to erect cooling towers.

2. Both industries need to cover a considerable acreage of ground and the works site should allow room for expansion.

3. Some attention must be paid to the 'pull of the market'. This is much more important with the gas industry, as gas cannot normally be transported over any considerable distance at an economic cost.

4. Both industries are decidedly conspicuous, and the siting of works in relation to the canons of town planning is important. Protests against the siting of gas and electricity works on aesthetic grounds are common today.

5. The problem of location cannot be completely separated from that of optimum size. Production should be planned so that it can be concentrated in works which are, as far as possible, when the other factors mentioned above are considered, of the optimum size for the industry concerned.

GAS

The attached map A[1] shows the distribution of gas undertakings in England and Wales, and the pre-nationalisation

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1. Cf. Maps A and C.

authorised areas of supply. This map shows quite clearly that municipal and company undertakings were not distributed at random but that some areas showed a definite concentration of either local authority or company control. The London area was obviously the great stronghold of the companies, particularly of a few very large companies - the Gas, Light and Coke (46,818,349 1000 cu.ft. available in 1944); South Metropolitan (11,412,127 1000 cu.ft. availaible in 1944), Wandsworth (6,974,987 1000 cu.ft. available in 1944); Tottenham (6,541,472 1000 cu.ft. available in 1944); South Suburban (5,045,156 1000 cu.ft. available in 1944) and Croydon (3,314,768 1000 cu.ft. available in 1944).[1]

The nearest municipal undertakings to London were Chelmsford, Southend and Sittingbourne. The chief centre of municipal gas was Lancashire, though the concentration was not so great as that of the companies around London - Liverpool in particular, representing an important company interest in this area. In the Lancashire conurbation few of the undertakings supplied very much more than their own municipal areas. In the rest of the country the pattern is more haphazard. The Sheffield Company, with its gas grid, supplied a considerable area of the South

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1. From Ministry of Fuel Ret., 1944.

Yorkshire coalfield. (Gas available 1944 = 15,100,660 cu.ft.)[1] Tyneside was a wholly company supplied area, based on the large Newcastle and Gateshead Company. Both the Black Country area and the South Wales coalfield had a number of both company and local authority undertakings, while the South-West was chiefly responsible for the large number of small non-statutory company undertakings. Some local authority undertakings did supply an area considerably larger than that covered by their municipal boundaries. Particularly noticeable are large areas supplied by Leeds, Birmingham, Nottingham, Chesterfield and Leicester.

Another noticeable feature of the map is the considerable differences between the authorised areas of supply and the actual areas supplied. Many companies and municipalities obtained powers to supply much larger areas than those in which they had actually laid pipes by 1945. Amongst the municipal undertakings some of the most obvious examples of this were Penrith, Darlington, Retford, Saffron Walden, Chelmsford and Spalding. The map also shows that considerable areas of the country were not included in any authorised area of supply. This was so more particularly, as would be expected, in the rural areas, such as East Anglia,

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1. From Ministry of Fuel Ret., 1944.

Northumberland, Central Wales, and the South West.

The actual pattern of location of gas undertakings and the degree of coincidence between authorised gas areas and the boundaries of local authorities can be seen when a small area is studied in detail. Worcestershire contained, in 1948, 21 local authorities - 2 County Boroughs, 7 non-County Boroughs, 4 Urban Districts, and 8 Rural Districts. There were 19 different gas undertakings supplying areas within the county. Each of the urban areas (i.e. County and non-County Boroughs and Urban Districts) was represented by at least one distinct gas undertaking.

Table 158. Gas Supplies in Worcestershire.

Urban areas in Worcestershire	Gas undertakings supplying area. (1948).
Dudley C.B.	Dudley, Brierley Hill & District Co.
Worcester N.C.B.	Worcester Co.
Bewdley N.C.B.	Unauthorised Co.
Bromsgrove U.D.C.	Bromsgrove Co.
Droitwich N.C.B.	Droitwich N.C.B.
Evesham N.C.B.	Evesham N.C.B.
Halesowen N.C.B.	Halesowen Co.) Cradley Heath Co.)
Kidderminster N.C.B.	Kidderminster Co.
Malvern U.D.C.	Malvern U.D.C.
Oldbury N.C.B.	Oldbury N.C.B.
Redditch U.D.C.	Redditch Co.
Stourbridge N.C.B.	Stourbridge N.C.B.
Stourport U.D.C.	Stourport Co

Municipal undertakings underlined in red.

The other undertakings supplying parts of Worcestershire were - Upton Non-Statutory Co.; Cheltenham Co., supplying parts of the Rural Districts of Pershore and Evesham; Bidford Non-Statutory Co. supplying parts of Rural District of Evesham; Tenbury Non-Statutory Co.; and Birmingham Corporation supplying a small part of the Rural District of Bromsgrove. This is a fairly typical structure - the development of large unified undertakings supplying several urban areas is exceptional in Britain. In Worcestershire only two of the undertakings - Droitwich and Evesham, coincided approximately with municipal boundaries. In most cases (e.g. Malvern, Kidderminster) the authorised area of supply was considerably larger than that of the urban local authority in the area. The framers of the Heyworth Report considered that - "in areas of high gas demand there is little or no justification for the continued survival of small works serving districts within easy transmission range of one or more large units."[1] "Easy transmission range" is not defined, but if we assume that this would cover all cases where areas supplied by different undertakings adjoin each other, then there would appear to be some small works in Worcestershire which should be closed. If the Heyworth Report's minimum size for normal efficiency of

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1. 'Heyworth' Report, Par.90.

operation is taken as a basis (i.e. 1.25 mill. therms[1]), then in the following cases there would appear to be a prima facie case for considering amalgamation because the output of gas is below this minimum and the area supplied adjoins that in which the mains of another undertaking are already laid:-

1. Evesham - Cheltenham - Bidford

   The respective sales of these undertakings were, in 1944: Evesham - .6 mill. therms; Cheltenham - 5.4 mill. therms; Bidford - 13,098 thousand cu.ft. Some degree of amalgamation was already achieved in this case as Bidford took bulk supplies of gas from Cheltenham.

2. Malvern - Colwall

   The sales of these undertakings in 1944 were: Malvern 1.25 mill. therms; Colwall .1 mill. therms.

3. Kidderminster - Stourport - Bewdley

   The sales in 1944 were: Kidderminster 1.4; Stourport .4; Bewdley 22,509 thous. cu.ft.

4. Redditch - Bromsgrove

   The sales in 1944 were: Redditch 3.7; Bromsgrove 1.1 mill. therms.

5. Halesowen - Cradley Heath - Stourbridge

   The sales in 1944 were: Halesowen 1.0 mill. therms; Cradley Heath 1.1 mill. therms; Stourbridge 2.7 mill. therms.[2]

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1. Cf. p.255 et seq.
2. Ministery of Fuel and Power Returns, 1944.

Whether the closing down of the smaller gas works in the above examples would actually be justified would, of course, depend on a number of additional factors:- the possibility of extending the larger works, the condition of the plant in the smaller works, and the ease with which the mains could be interconnected. Worcestershire is fairly typical, in the number of cases where the amalgamation of existing undertakings seems desirable, which it provides. The area in which there are the greatest number of small works with adjoining areas of supply is South Lancashire. The following Table shows the number of separate undertakings existing in the area between Manchester and Liverpool all with supply areas touching those of one or more of the other undertakings in the list.

Table 159. Gas undertakings in area between Liverpool and Manchester.

Undertaking	Sales - Mills of therms, 1944.	Co. or l.a.[1]
Middleton	1.2	L.a.
Heywood	0.9	L.a.
Bury	2.4	L.a
Radcliffe	2.7	Co.
Worsley	0.1	L.a.
Salford	7.6	L.a.
Stretford	9.4	L.a.
Altrincham	2.5	L.a.
Atherton	0.4	L.a.
Leigh	1.6	L.a.
Golborne	0.1	Co.
Skelmersdale	0.1	L.a.
Hindley	0.4	L.a.
Newton-le-Willows	0.7	L.a.
Ashton-in-Makerfield	0.3	L.a.
St. Helens	6.9	L.a.
Wigan	3.4	L.a.
Widnes	2.7	L.a.
West Houghton	0.1	Co.
Lymm	0.1	L.a.
Warrington	5.2	L.a.
Tyldesley	0.3	L.a.
Chorley	1.5	L.a.
Prescot	1.2	Co.

Undertakings falling below Heyworth Report minimum size are underlined in red.

1. Ministry of Fuel and Power Returns, 1944.

Thus in this area 13 out of 24 undertakings were below the minimum size though forming part of a large industrial area throughout which gas is supplied. Worsley did not produce its own gas but bought this in bulk from the Radcliffe Co.

It might be supposed that company undertakings would be more free to extend supplies outside the original centre of the undertaking than those operated by local authorities, but an examination of the map indicates that on the whole this does not appear to have been the case. The larger urban undertakings mostly supplied considerable quantities of gas to consumers in adjoining districts irrespective of whether the undertaking was owned by a company or a municipality. Company undertakings were not noticeably more successful in building up supply areas outside the municipal boundaries of the original undertaking than were local authority owned ones. A possible exception to this was Sheffield, which did have a very large supply area, but this undertaking was peculiarly favourably placed for such expansion, because of the possibility of developing a gas grid based on coke oven supplies. In the London area large districts were allocated to a few companies by the Act of 1860, but there was no further amalgamation of note.

It does not seem to be worth while to attempt any definite measurement of the comparative geographic expansion

of municipal and company undertakings (based for example on the relation between the population of the 'home town' of the undertaking and the total number of consumers, or miles of main) because the conditions for such expansion vary considerably. All that can be done is, as already stated, to use the map as a basis of comparison, paying particular attention to pairs of company and municipal undertakings which appear to be roughly in the same situation in regard to the potential demand from surrounding areas (e.g. - Nottingham and Derby, Leicester and Northampton, Malvern and Worcester, Stratford and Warwick, Preston and Bolton).

ELECTRICITY

The only important raw materials required in the electricity industry are coal (or coke), oil and water. Apart from hydro-electric stations generating stations can thus be built wherever fuel and water can be supplied. Since there are greater economies of scale to be reaped in electricity manufacture, as compared with the gas industry, and current can be more readily transported than can gas, it might be expected that electricity generation would be more highly localized than gas manufacture. On the other hand, the grid system makes it possible for power stations

to be built at a distance from the chief centres of demand while gas manufacture is confined to the urban areas in which it is supplied.

The total amount of current generated in 1947-8 in England and Wales was 39,893,775 thousand units. This total was made up as follows:-

Local authorities	21,212,011	thousand units[1]
Other public authorities	1,582,868	" "
Companies	17,088,896	" "
TOTAL	39,893,775	" "

The local authorities thus generated rather less current than the extent of their distributing areas would suggest. (Total net sales G.B. 1947-8 - Public authorities 21,670,917; companies 14,072,057.)[2] In 1947-8 public authorities undertakings purchased 2,298,567 thousand units as direct bulk supplies from company undertakings and companies bought 1,129,246 thousand units from public undertakings, (this excludes all operations of the Central Electricity Board).[3]

Electricity undertakings may be divided into three groups on a basis of their position in generating current - those which consumed more energy than they generated and may

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1. Compiled from Min. of Fuel and Power R.E.F.S. 1947-8.
2. Ibid.
3. Ibid.

be called "importers" of current, the few undertakings which were just self-supporting, and those undertakings which generated more current than they consumed and may be called "exporters". It is this last class of exporting undertakings which is obviously of most interest in considering the location of electricity generation. The exporting undertakings were almost all owners of "selected" stations, and the greater part of the current exported was accounted for by the difference between the total sold to the Central Electricity Board and the amount bought back from the Board. There was also a considerable export as bulk sales to other authorised undertakings, and a few undertakings which would fall into the importers group are revealed as "net exporters" of current when these bulk sales are taken into consideration. The following Table (160) shows the local authority undertakings which were net exporters of current in 1947-8.

Table 160. Local authority electricity undertakings exporting current in 1947-8.[1]

Undertakings	Surplus(+)or defitic(-) total generated less total requirements	Bulk sales to other authorised undertakings	Total net exports
	Thousand units		
Birmingham	+ 587,366	30,254	617,620
Blackburn	+ 264,484	17,043	281,527
Bolton	+ 60,782	-	60,782
Brighton	+ 180,897	50,232	231,129
Bristol	+ 400,560	75,187	475,747
Burton	+ 49,360	7,486	56,846
Cardiff	+ 134,376	566	134,942
Carlisle	+ 309,950	111	310,061
Croydon	+ 45,076	-	45,076
Darlington	+ 227,427	-	227,427
Derby	+ 42,936	-	42,936
Fulham	+ 1,662,030	-	1,662,030
Gloucester	+ 97,026	-	97,026
Hackney	+ 65,763	24,774	90,537
Halifax	+ 17,884	3,982	21,866
Huddersfield	+ 65,129	-	65,129
Hull	+ 120,897	28,442	149,339
Lancaster	+ 114,320	38,625	152,945
Leeds	+ 324,314	14,601	339,115
Leicester	+ 63,062	-	63,062
Liverpool	+ 724,386	-	724,386
Manchester	+ 120,897	121,669	242,566
Newport, Mon.	+ 107,710	123	107,833
Norwich	+ 90,005	2,915	92,920
Nottingham	+ 243,020	-	243,020
Plymouth	+ 74,798	21,520	96,318
Portsmouth	+ 54,453	22,852	77,305
Preston	+ 45,727	216,464	262,191
Rotherham	+ 184,307	9,070	193,377
Sheffield	+ 353,351	-	353,351
Southampton	+ 12,604	20,123	32,727
Stalybridge	+ 244,488	-	244,488
Stepney	+ 60,569	5,941	66,510
Stockport	+ 152,914	37,360	190,274
Sunderland	+ 49,966	-	49,966
Swansea	+ 521,793	48,643	570,436
Swindon	- 30,374	38,008	7,634
Torquay	+ 10,577	30,023	40,600
Warrington	+ 72,838	-	72,838
Woolwich	+ 6,621	103,213	109,834
Worcester	+ 50,051	6,861	56,912
OTHER PUBLIC UNDERTAKINGS			
West Midlands J.E.A.	- 67,448	932,102	864,654
Central Electricity Board			269,636a

1. Compiled from Min. of Fuel and Power, R.E.F.S., 1947-8.

NOTE

a - This figure represents difference between amount of current generated at the Board's station at Earley and direct sales to consumers (for transport purposes), allowing for "units used on works" at Earley but not for "units lost and unaccounted for".

The following Table (161) shows the same figures for company undertakings.

Table 161. Company Electricity Undertakings exporting current in 1947-8.[1]

Undertakings	Surplus(+) or deficit(-) total generated less total requirements	Bulk sales to other authorised undertakings	Total net exports
Bedfordshire	+ 309,902	39,036	348,938
Cornwall	- 13,557	30,103	16,546
County of London	+ 363,158	902,036	1,265,194
Derbyshire	+ 167,917	277,823	445,740
Isle of Wight	+ 2,543	-	2,543
Kent	+ 272,405	80,354	352,759
Lancashire	+ 79,405	339,844	418,884
London Power	+ 1,351,489	1,760,540	3,112,029
Mersey	+ 131,012	39,663	170,675
North Eastern	- 137,139	296,704	119,565
Northampton	+ 50,195	40,843	91,038
Shrops.,Worcs., and Staffs.	- 35,254	51,688	16,434
South Wales	+ 367,439	233,491	600,930
Yorkshire	+ 227,299	432,700	659,999

These tables show that the municipally owned generating stations which were built up as exporters of current by the Central Electricity Board were almost exclusively those

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1. Calculated from Min. F. & P. R.E.F.S. 1947-8.

of the larger urban undertakings. When the list of municipally owned exporters is compared with that of company exporters, and, bearing in mind economic factors likely to influence the location of the industry, it seems reasonable to assume that the participation of local authorities in the electricity industry has resulted in a greater degree of concentration of generation in or close to the largest towns, than might otherwise have been the case. Table 162 shows the changes in the position of "exporting" stations in the period between 1939 and 1948. It is based on stations which were exporting to the grid (i.e., excluding those which only became exporters when bulk sales to other undertakings were taken into account) in 1947-48.

Table 162. Generation and home consumption of energy by municipal "exporting" undertakings 1939-1948.[1]

Undertaking	Energy generated 1000 units		Home consumption 1000 units	
	1939	1948	1939	1948
Birmingham	1,220,089	2,058,110	920,206	1,470,744
Blackburn	33,660	395,908	61,968	131,424
Bolton	36,757	235,828	116,513	175,046
Brighton	315,167	378,296	138,939	197,399
Bristol	607,185	879,334	334,994	478,774
Burton	14,121	145,815	56,016	96,455
Cardiff	81,769	407,933	161,899	273,557
Carlisle	55,962	367,873	37,351	57,923
Croydon	256,477	206,331	125,786	161,255
Darlington a	26,427	315,844	51,341	88,417
Derby	66,730	237,852	115,139	194,916
Fulham	964,203	1,735,292	61,387	73,262
Gloucester	1,698	162,909	29,528	65,883
Hackney	188,309	203,056	101,572	137,293
Halifax	82,378	121,477	66,640	103,593
Huddersfield	64,022	260,860	103,524	195,731
Hull	366,754	519,588	258,881	398,691
Lancaster	5,505	226,149	69,218	111,829
Leeds	439,176	767,649	298,092	443,135
Leicester	188,887	338,794	176,412	275,732
Liverpool	1,113,887	1,539,398	584,162	869,012
Manchester b	1,008,344 b	1,029,692	622,387	886,295
Newport, Mon.	123,234	228,210	63,451	120,500
Norwich	260,342	235,590	103,103	145,585
Nottingham b	395,598	547,531	186,587	304,511
Plymouth	76,131	182,896	62,375	108,098
Portsmouth	102,453	268,468	158,762	214,015
Preston	149,049	431,688	193,211	385,961
Rotherham	157,980	553,782	172,867	369,475
Sheffield	754,024	1,276,429	597,433	923,078
Southampton	299,989	174,855	109,902	162,251
Stalybridge	126,120	387,295	79,969	142,807
Stepney	78,825	153,416	127,611	92,847
Stockport	77,435	289,364	91,593	136,450
Sunderland a	30,783	162,458	64,316	112,492
Swansea	356,933	706,133	276,501	184,340
Torquay	43,235	110,093	56,588	99,516
Warrington	1,638	240,698	64,227	167,860
Woolwich	90,834	249,994	181,045	243,373
Worcester b	3,243 b	121,431	38,022	71,380

Notes

a-Including generation as non-selected station for part of the year.

b-Excluded energy generated in small non-selected station.

1. Min. of Fuel and Power R.E.F.S. 1947-8.
   E.C. - R.E.F.S. 1938-39 - 1942-43.

Table 163, shows the changes in the size of the actual export surpluses of the same undertakings.

Table 163. Changes in size of "export surplus" of municipal electricity undertakings, 1939-48.[1]

Undertaking	Export surplus(+) or deficit (-)		Increase (+) or decrease(-) in surplus	Thermal efficiency
	1939	1948		a
Birmingham	+ 299,883	+ 587,366	+ 387,483	18.71,26.75 10.6
Blackburn	- 28,308	+ 264,484	+ 292,792	22.82
Bolton	- 79,756	+ 60,782	+ 140,538	19.67
Brighton	+ 176,228	+ 180,897	+ 4,669	22.23
Bristol	+ 272,191	+ 400,560	+ 128,369	10.87,20.21
Burton	- 41,895	+ 49,360	+ 91,255	19.41
Cardiff	- 80,130	+ 134,376	+ 214,506	19.76
Carlisle	+ 18,611	+ 306,950	+ 288,339	21.75
Croydon	+ 130,691	+ 45,076	- 85,615	18.62
Darlington	- 24,914	+ 227,427	+ 252,341	19.34
Derby	- 48,409	+ 42,936	+ 91,345	20.90
Fulham	+ 902,816	+ 1,662,030	+ 759,214	26.32
Gloucester	- 27,830	+ 97,026	+ 125,036	24.53
Hackney	+ 86,737	+ 65,763	+ 20,974	19.82
Halifax	+ 15,738	+ 17,884	+ 2,146	17.07
Huddersfield	- 39,502	+ 65,129	+ 104,631	-
Hull	+ 107,873	+ 120,897	+ 13,024	22.08
Lancaster	- 63,710	+ 114,320	+ 178,030	22.46
Leeds	+ 144,084	+ 324,514	+ 180,430	21.70,10.51
Leicester	+ 12,475	+ 63,062	+ 50,587	20.28
Liverpool	+ 529,725	+ 724,386	+ 194,661	23.23,15.04
Manchester	+ 385,957	+ 120,897	- 265,060	18.34,19.14
Newport, Mon.	+ 59,783	+ 107,710	+ 49,927	19.19
Norwich	+ 157,239	+ 90,005	- 67,234	19.47
Nottingham	+ 209,011	+ 243,020	+ 34.009	21.37
Plymouth	+ 13,756	+ 74,798	+ 61,042	18.75
Portsmouth	- 56,309	+ 54,453	+ 110,762	19.77
Preston	- 44,162	+ 45,727	+ 89,889	20.00
Rotherham	- 14,887	+ 184,307	+ 199,194	22.25
Sheffield	+ 156,591	+ 353,351	+ 196,760	23.14,21.63
Southampton	+ 189,996	+ 12,604	- 177,392	18.01
Stalybridge	+ 46,151	+ 244,488	+ 198,337	21.64
Stepney	- 48,786	+ 60,569	+ 109,355	18.14
Stockport	- 14,158	+ 152,914	+ 165,072	20.73
Sunderland	- 33,533	+ 49,966	+ 83,499	19.11
Swansea	+ 80,432	+ 521,793	+ 441,361	19.21
Torquay	- 13,353	+ 10,577	+ 23,930	15.46
Warrington	- 62,589	+ 72,838	+ 135,427	21.23
Woolwich	- 90,211	+ 6,621	+ 96,832	20.92
Worcester	- 34,779	+ 50,051	+ 84,830	21.02

1. E.C. and Min. of Fuel and Power R.E.F.S. 1938-39 and 1947-48; and E.C. Gen. Elec. 1947.

Note.
a - Where more than one generating station was owned the thermal efficiency of each station is shown. These figures relate to the year ended 31st December, 1947.

These figures show that the number of exporting undertakings increased considerably during this period. Nineteen undertakings which were importers in 1939 had become exporters of energy in 1948. There were only two municipal undertakings (not shown in the Table) which were exporters in 1939 but had ceased to occupy this position by 1948. These were Oldham and Swindon, both exporting only a small amount of the energy which they generated in 1939. Of the 21 undertakings which had an "export surplus" in both 1939 and 1948, 17 had increased the size of their surplus by the later year, while four had smaller exports in 1948. The main results of the policy of the Central Electricity Board appear to have been to increase the capacity of the selected stations of the larger urban undertakings more than the growth of their home demand, (e.g., Fulham) and to allow the construction of new selected stations by some of the medium size urban undertakings (e.g., Gloucester, Worcester). The four cases where the export surplus decreased were all large undertakings with stations of relatively low thermal efficiency for their size. In three cases the number of units generated decreased

absolutely (Croydon, Norwich and Southampton) while in the fourth the units generated increased less than home consumption (Manchester).

The fact that (apart from the London area where cheap transport of coal via the Thames has been the chief localising factor) the company owned exporting stations were mostly situated away from the large towns (e.g., Hayle, Little Barford, Stourport) is not in itself very strong support for this conclusion since the company supply areas do not usually include the larger towns. But it is difficult to believe that generation would have become so largely localised in the larger towns on economic grounds alone, and without the influence of municipal control strengthened by the historical fact that the larger towns were generally those first supplied with energy and in which the larger power stations were naturally first built.

An examination of the actual sites of some of the more modern generating stations shows that the tendency is for them to be built just outside rather than actually in the larger towns. This is presumably a result of higher land values and congestion in the centres of most large towns. Examples of this tendency are the Hams Hall station at Castle Bromwich on the outskirts of Birmingham, the Coventry station at Longford, and the Bristol station at Portishead. Nationalisation may well strengthen this

tendency to site generating stations away from the larger towns.

Although the municipal exporting generating stations are mostly those of the larger urban undertakings, the proportion of energy exported does not vary in any obvious relationship to the size of the station or of the local supply area. The following Table (164) shows all those undertakings exporting more than 50% of the energy generated in 1948-9.

Table 164. Municipally-owned generating stations exporting more than 50% of energy generated in 1948-9.[1]

Undertaking	Total generated	Total exported	Total sold in own supply area
Blackburn	395,908	281,527	102,434
Brighton	378,296	231,129	130,844
Bristol	879,334	475,747	362,226
Carlisle	367,873	310,061	50,471
Darlington	315,844	227,427	83,440
Fulham	1,735,292	1,662,030	62,992
Gloucester	162,909	97,026	60,248
Lancaster	226,149	152,945	68,964
Plymouth	182,896	96,318	77,812
Preston	431,688	262,191	153,456
Stalybridge	387,295	244,488	130,343
Stockport	289,364	190,274	90,927
Swansea	706,133	570,436	124,285

The actual balance between exporting and importing undertakings can be illustrated by considering two areas in

1. Min. of Fuel and Power, R.E.F.S. 1947-8.

detail. The first area chosen corresponds roughly to that of the South Western Electricity Board. The undertakings included were:-[1]

Companies Cornwall, Urban Electric, St. Austell, Bude, Holsworthy, West Devon, Bideford, Ilfracombe, Lynton, Exe Valley, Minehead, Wellington, Culm Valley, Teignmouth, Chudleigh, Dawlish, Salcombe, Brixham, Paignton, East Devon, Seaton, Burnham, Bridgwater, South Somerset, Weston, North Somerset, Mid Somerset.

Local authorities Plymouth, Plympton, Torquay, Exeter, Tiverton, Barnstaple, Taunton, Bridport, Lyme Regis, Bristol, Bath.

The position in regard to generation and sales was as follows:-

Companies

Number of undertakings	- 27
Number of undertakings generating some current	- 13
Number of undertakings having exportable surplus	- 1
Number of self-supporting undertakings	- 1
Number of wholly-importing undertakings	- 13
Total current required	- 587,056 thousand units
Bulk sales to other authorised undertakings	- 163,764 thousand units
Net sales to own consumers	- 423,292
Total generated	- 188,036
Net deficit	- 235,256

1. Min. of Fuel and Power, R.E.F.S. 1947-8.

Local authorities

Number of undertakings - 11

Number of undertakings generating some current - 8

Number of undertakings having exportable surplus - 3

Number of wholly importing undertakings - 3

Total current required - 998,702 thousand units

Bulk sales to other authorised undertakings - 244,345

Net sales to own consumers - 754,357 thousand units

Total generated - 1,210,047 thousand units

Net surplus - 455,690 thousand units

TOTALS

Total net sales - 1,177,649 thousand units

Total generated - 1,398,083 thousand units

Total net surplus - 220,434 thousand units

The other area chosen was that of the West Midlands, and the undertakings included were:-[1]

Companies West Gloucester, Thornbury, Chepstow, Monmouth, Stroud, Shropshire, Worcestershire and Staffordshire, Midland Electric, Chasetown, Trent Valley, Market Drayton.

Local authorities Congleton, Leek, Newcastle, Stoke, Stafford, Stone, Lichfield, Cannock, Wolverhampton, Walsall, West Bromwich, Sutton Coldfield, Birmingham, Worcester, Llandrindod Wells, Malvern, Gloucester, Cheltenham, Warmley.

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1. Min. Fuel and Power, R.E.F.S. 1947-8.

Joint Electric Authority North West Midlands, West Midlands.

The generation and sales position was as follows:-

Companies

Number of undertakings - 10

Number of undertakings generating some current - 4

Number of undertakings having exportable surplus - 1

Number of wholly importing undertakings - 6

Total current required - 1,255,826 thousand units

Bulk sales to other authorised undertakings - 67,178 thousand units

Net sales to own consumers - 1,188,648 thousand units

Total generated - 761,110 thousand units

Net deficit - 427,538 thousand units

Local authorities and Joint Authorities

Number of undertakings - 21

Number of undertakings generating some current - 10

Number of undertakings having exportable surplus - 3

Number of wholly importing undertakings - 11

Total current required - 4,081,852 thousand units

Bulk sales to other authorised undertakings - 1,299,528 thousand units

Net sales to own consumers - 2,782,324 thousand units.

Total generated - 3,400,531 thousand units.

Net surplus - 618,207

TOTALS

Total net sales - 3,970,972 thousand units

Total generated - 4,161,641 thousand units

Total net surplus - 190,669 thousand units

Both sample areas thus had a net surplus of energy generated. In each case the Company undertakings required more current than they generated but this was more than made up by the surpluses generated by the local authority undertakings. Out of the total of 1,398,083 thousand units generated in the South-Western region in 1947-8, 1,344,149 thousand units, or 96.1% was generated by the four "exporting" undertakings. The geographic location of generation in this region was thus as shown in Table 165.

Table 165. Location of 96.1% of energy generated by exporting undertakings in South Western area, 1947-8.[1]

Undertaking	Location of station(s)	Stations total as % of total energy generated in area
Cornwall Electric Power Co.	Hayle North West Cornwall	12.3
Plymouth County Borough Council	Plymouth	13.1
Torquay Borough Council	Newton Abbott, S.Devon	7.9
Bristol County	1.Bristol(40 million units)[a] 2.Portishead (843 million units)[a]	62.9
Total		96.2[b]

Notes a- Figures relate to 1947 and are to nearest 100,000.
b- Error of .1 as figures shown to nearest first decimal place.

1. Calculated from Min. Fuel and Power R.E.F.S. 1947-8 and E.C. Gen. of Elec. 1947.

Of the total of 4,161,641 thousand units generated in the Midland area in 1947-8, 4,039,090 thousand units, or 97.1% were generated by the five "exporting" undertakings. The exact geographic location of generation in this area is shown in Table 166.

Table 166. Location of 97.1% of energy generated by "exporting" undertakings in Midlands area, 1947-8.[1]

Undertaking	Location of station(s)	Stations total as % of total generated in area
Shropshire, Worcs. and Staffs. Electric Power Co.	Stourport, Worcs.	17.3
West Midlands Joint Electricity Authority	1. Ironbridge, Salop. (758 million units)[a] 2. Ocker Hill, South Staffs. (34 million units)[2] 3. Shrewsbury (2 million units)[a] 4. Walsall (35 million units)[a] 5. Wolverhampton (151 million units)[a]	23.5
Birmingham County Borough Council	1. Hams Hall (1,959 million units)[a] 2. Nechells (114 million units)[a]	49.5
Gloucester County Borough Council	Castle Meads, Gloucester.	3.9
Worcester County Borough Council	1. Hylton Road, Worchester (121 million units)[a] 2. Powick, Worcs. (.3 million units)[a]	2.9
Total		97.1

Note a-Figures relate to 1947 and are to nearest 100,000

1. Calculated from Min. of Fuel and Power R.E.F.S. 1947-8 and E.C. Gen. of Elec. 1947.

Coal is conveyed to the power stations by rail, ship, canal and road (mainly coal from opencast sites). The following Table (167) shows the use made by these methods of transport in supplying all the stations in what are now the Midland and South Western Divisions of B,E.A. in 1947.

Table 167. Transport of Solid Fuel, South Western and Midland Areas 1947[1]

Area	Method of transport: Rail	Ship	Canal	Road	Total
	Thousand Tons				
Midland	2,529	-	307	305	3,141
South Western	239	630	-	-	869

The relative importance of the different means of transport in the case of the individual "exporting" stations listed above is given in the following Tables (168 and 169).

Table 168. Approximate importance of different transport methods used to supply coal to "exporting" electricity stations in Midland area, 1947.[2]

Area	Method of transport: Rail	Ship	Canal	Road	Total
Ironbridge	80	-	-	20[a]	100
Ocker Hill	70[b]	-	70[b]	30	100
Walsall	-	-	95	5	100
Wolverhampton	10[c]	-	90	-	100
Hams Hall	95	-	-	5[a]	100
Nechells	64	-	32	4	100
Castle Meads	100	-	-	-	100
Worcester	100	-	-	-	100
Stourport	60	-	25	15[a]	100

Notes a- For opencast supplies, and supplies from small pits
b- 70% rail and canal combined
c- 10% rail and canal combined

1. Information received from British Electricity Authority, 22.v.51.
2. Ibid., 4.vi.51.

Table 169. Approximate importance of different transport methods used to supply "exporting" electricity stations in South Western Area, 1947.[1]

Station	Means of transport % Rail	Ship	Total
Hayle	-	100	100
Plymouth	-	100	100
Newton Abbott	100	-	100
Bristol	-	100	100
Portishead	20	80	100

These Tables show that rail and canal were the predominant means of transport in the Midlands, while ships were easily most important in the South West. Some of the 1947 figures must be regarded as abnormal, as owing to the shortage of coal it was necessary to draw on supplies of coal from places other than those anticipated when the stations were built. Thus the use of road transport was largely a result of the need to draw on coal from opencast sites. The 20% of coal brought by rail to the Portishead station was carried from the Midlands owing to the shortage of Welsh coal.

The economic factors of water and coal supply do not appear to have been wholly responsible for deciding the location of power stations. The early development of

1. Information from B.E.A., 4.vi.51.

electricity supply in the big towns has resulted in a greater concentration of generating stations in densely populated regions than would be justified on purely economic grounds. The pull of the market is less important theoretically than it has proved in fact. This conclusion is supported by information obtained from the British Electricity Authority which includes the statement ... "The location of the generating plant existing in 1947 was influenced by factors other than purely economic considerations, such as the size of the Undertaking, the local demand for electricity, the relations between the undertaker and the neighbouring authorities and the basis of trading between the owner of a selected station and the Central Electricity Board as laid down in the Electricity (Supply) Act of 1926. The prestige value of owning a "selected" generating station was very considerable."[1]

The main conclusions of this investigation of some general problems relating to location are then, as follows. There is no noticeable difference in the success of company and municipal gas undertakings in crossing municipal boundaries and in expanding supplies to neighbouring areas. It seems probable that municipal ownership has led to a bigger concentration of electricity generation near to the large urban centres than would otherwise have been the

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1. Information from B.E.A., 4.vi.51.

case. (No investigation of the actual siting of individual gas works has been made because nearly all works have been built in or very close to, the urban areas which they supplied, and it seems unlikely that it would be possible to point to any real difference resulting from the different types of ownership.)

It seems to be established that both in the gas and electricity industries, the location of manufacture or generation was planned less satisfactorily than it would have been under a different form of organisation. This was particularly true with electricity, where the optimum size of a power station was too large for the needs of all but a few of the largest undertakings. Even after the formation of the Central Electricity Board in 1926, and the semi-nationalisation of generation, the location of generation does not appear to have been determined by economic factors alone. In the gas industry economies of scale were much less important, but even so there were undoubtedly a number of unnecessarily small and inefficient gas works kept in operation as a result of the existence of so many independent company and municipal undertakings. This was particularly true in the Lancashire and West Riding conurbations.

CHAPTER IV

Administration

There are two main aspects of the administration of publicly and privately owned gas and electricity undertakings which may be compared. These are the actual form of administration - the machinery through which the undertakings were managed; and the underlying assumptions guiding those responsible for making decisions. In this chapter attention is concentrated on the first of these and only passing reference made to the second, which is considered against the wider background of nationalised industry, in the final conclusion.

The most important part of the municipal form of administration of gas and electricity undertakings was the Committee. The Committees were composed of about fifteen councillors, and were usually responsible for making most of the decisions relating to their undertaking, though they could not raise a loan or levy a rate themselves. Their resolutions needed to be approved by the Council, but in the great majority of cases this approval

was automatic. (The results of an investigation of the attitude of Councils to the resolutions of their trading committees is given below.)[1] Most gas and electricity committees met once a month as a matter of routine, with an occasional special meeting should circumstances demand this. The main link with the staff of the undertaking was the chief officer - the Gas or Electricity Engineer, who would be available to give advice at all meetings of the appropriate committee. It is not possible to generalise about the length of service of individual councillors on these committees. There was a tendency for some councillors to specialise, and to remain members of one committee for a number of years. Often the Chairmen of gas or electricity committees had been members of their committee long enough to obtain a really intimate knowledge of the problems of the industry. On the other hand the development of party politics in local government tended to work against continuity of service in many areas.

The body in control of the administration of gas and electricity joint stock companies was the Board of Directors. Most boards had about eight members and met once a month. They were ultimately responsible to the

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1. Cf. p. 423 et seq.

shareholders, to whom they had to report at the annual general meeting of the company. The reality of the control of shareholders depended mainly on the distribution of the ownership of shares. Only where a small group of shareholders owned a considerable proportion of the Ordinary shares (it has been argued that, where the rest of the shares are widely divided amongst a large number of shareholders, a holding of 20% of the Ordinary capital is sufficient to give working control, were they likely to exercise effective control. Even where there were a few very large shareholders control may still have been with the Board of Directors since the large shareholders may themselves have been directors. The connection between the Board and the staff varied to some extent between different companies. Some companies had a Managing Director who was both a member of the Board and in charge of the staff. In other cases the chief official was the General Manager, who might be consulted by the Board but was not himself a member of it. Most commonly the directors of gas and electricity undertakings retained their office for a number of years.

Before attempting to compare the probable results of these differences in the administrative machinery of company and electricity undertakings, there is one fairly obvious,

but important, point which must be made. The administration of any undertaking is based upon personal decisions made by individuals. This makes generalisations exceptionally dangerous here. It is not safe to assume that the form of the machinery of administration will always impose the same pattern of behaviour upon those responsible for making managerial decisions. Thus, for example, even though we may conclude that it should be easier to make speedy decisions in a joint stock company than in a municipal department, it is evident that the management may either overcome the difficulties of their situation, or neglect their opportunities, as the case may be.

There are a number of points where the administrative machinery of the municipal and company undertakings may be compared. Firstly the position of the directors and committee members may be considered. Directors normally had the advantage of a more secure position, with the possibility of obtaining a greater knowledge of the undertaking than the average councillor. On the other hand, it was probably easier for councillors to have a deeper knowledge of local affairs and needs. This would, of course,

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1. Sargent, Florence, The Logic of British and American Industry, p. 127 et seq.

depend partly on the size of the company owning the gas or electricity undertaking. With the smaller companies the directors may well have been local inhabitants, but in many cases their interest in the company would be purely financial. The considerable growth of holding companies in the gas and electricity industries exemplified by such companies as Edmundsons Electricity Corporation, controlling undertakings spreading from Cambridge to Cornwall, obviously tended to make it difficult for directors to have much local knowledge. Not only was the final power of control removed from the Boards of the subsidiary companies, but also very often the same directors were appointed by the controlling company to the Boards of a considerable number of subsidiaries. It is not possible to make any judgements on the probable managerial ability of directors and councillors as a class without discussing the question of motives which, as already explained, is reserved for treatment in the conclusions. Since company directors are, presumably, chosen from those who would be expected to be successful in controlling an enterprise, (allowing of course for nepotism and the effects of inheritance) whereas electors do not normally have the success of any particular enter rise in mind when they choose their councillors, it might be argued that the

average director is more likely to be a good manager than the average councillor. In an article of the Public Corporation Sir Henry Bunbury made the criticism of the municipal committee system "The municipal set-up of an executive technician working under the direction and supervision of a lay committee of councillors, chosen for all sorts of irrelevant reasons and frequently changing, is obsolete, at any rate under modern technological conditions. It belongs to a simpler age."[1] Many years earlier Mr Bernard Shaw had written of " ... petty shopkeepers and employers whose cramped horizon and short-sighted anxiety to keep down the rates at all costs are the main stumbling blocks in the way of municipal enterprise."[2]

These rather gloomy pictures of the qualities of local councillors cannot be accepted unreservedly, however.

A comparison of the officials employed by company gas and electricity undertakings reveals a rather different situation from the director-councillor comparison. The chief officials of company and municipal undertakings are much more likely to have had similar backgrounds and training than councillors and directors. The same professional bodies included both municipal and company employees in

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1. Bunbury, The Public Corporation, Public Administration, Winter 1944/5.
2. Shaw, Common Sense of Municipal Trading, p.110.

their membership, and officials could quite easily pass from company to municipal employment, and vice versa, (the only barrier of importance being the provisions of superannuation schemes). Although administrative ability is not capable of any direct measurement itself some comparison of the possible level of quality of the managerial staffs of municipal and company undertakings is possible. In any attempt to compare the quality of the officials of municipal and company undertakings there are two distinct factors to be considered: technical knowledge and administrative ability. In the smaller undertaking both of these would need to be combined, theoretically, to make a good manager. How far it is desirable to have a chief official in a large undertaking who is a pure administrator, relying on technicians for advice is of course a very debatable issue. In practice all municipal undertakings, and most company undertakings, appointed trained gas engineers to the chief executive posts. Only in a few of the larger company undertakings was room found for the pure administrator. Thus out of all the advertisements for managerial posts appearing over a period of eighteen months (1945-6) in the Gas Journal, nearly all specifically asked for technical qualifications, and only two made it clear that these were not essential. These two, Brighton and Croydon,

were both amongst the larger company undertakings. The Brighton company called for a General Manager (at £ 1600) with "administrative ability" and stated that technical qualifications were not essential. The Croydon Gas Co. advertised for a General Manager (at £ 2250) with commercial and industrial experience, and stated "knowledge of the gas industry an added qualification".

A study of all the vacancies advertised in the Gas Journal in the same period (1945 - mid 1946) showed that (with the exception noted above of the chief managerial posts in two company undertakings) company and municipal undertakings required the same technical qualifications for similar posts. The main qualification required from gas engineers, according to the grade of post, were - the Institute of Gas Engineers Ordinary Grade Certificate (for such posts as Junior Technical Assistant) the Institute of Gas Engineers Higher Grade Certificate (which could relate to manufacture or distribution), (Mainly for Technical Assistant and Works Manager posts) and Associate and Corporate Membership of the Institute of Gas Engineers (for the higher grade posts).

There was no apparent difference between the staffs of municipal and company undertakings as far as basic technical qualifications were concerned. An examination

of the advertisements for managerial posts in the electricity supply industry over a period of a year (1946) showed that the position was the same as with the gas industry as far as basic technical qualifications were concerned. No cases were found in which technical qualifications were not asked for, but the sample contained relatively few company undertakings.

It is evident, however, that the quality of staff having the same technical qualifications can vary very considerably. The only objective measurement of possible quality, imperfect though it is, is that of the salary paid. If, as has sometimes been suggested, company electricity and gas undertakings paid higher wages to their chief officials than it is reasonable to assume that they would attract staff of a higher quality. The following Table shows the average starting salaries for the managers and assistant managers of gas undertakings included in the Gas Journal sample.

Table 170. Salaries for managerial posts in municipal and company gas undertakings, 1945-6.

Post	Average starting salary	
	Companies	Local authorities
Manager	£ 881	£ 1195
Assistant Manager	£ 478	£ 690

1. Calculated from advertisements in the Gas Journal, 1945-6.

It is necessary to treat these figures with considerable caution. Managerial salaries vary with the size of the undertaking as well as with ownership, and therefore the existence of a relatively large number of small municipal undertakings would tend to reduce the average level of salary paid ... Also the chief managerial posts in company and municipal undertakings did not necessarily cover the same range of duties. Some of the managers of company undertakings may have had to perform duties which in municipal undertakings were carried out by the Clerk or the Treasurer. There was a Scale of Salaries drawn up by the Institution of Gas Engineers which related sales of gas to the minimum commencing salary. This scale was approved by the General Purposes Committee of the Association of Municipal Corporations, but it was not compulsory, and to judge from the advertisements studied it was not very widely adopted. It is interesting to note that the details of the Scale (drawn up in December 1944) state that " ... the above scale should apply to Chief Gas Engineers only and should be adequately increased to cover additional duties such as those as General Manager and/or Secretary".[1]

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1. Information supplied to me by Dr W, Braunholtz, Secretary of the Institution of Gas Engineers.

Subject to these qualifications, the evidence indicates that gas companies were more generous in the salaries which they paid to the chief officials than were local authorities. In some cases the provisions of municipal superannuation schemes, and the possibly greater security of municipal employment may have offset this salary differential.

The authors of the 'Heyworth' Report states that "The salaries paid to trained gas engineers are, in many instances, materially below those paid in other industries for work of equal responsibility. In this connection the municipal undertakings afford too many examples of inadequate salary scales."[1]

The position in the electricity supply industry was rather different. The industry was one of the first to adopt the Whitley system of Joint Industrial Councils, and scales for all posts up to that of a deputy chief official, were laid down by a National Joint Board (the salaries being graded according to the nature of the post and the size of the undertaking) for both municipal and company undertakings. Writing in the Electrical Times, Mr W. Arthur Jones stated that there was "little to choose between the company or the local authority" from the

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1. Heyworth Report, Cmd 6699, par 164.

employee's point of view."[1] For the chief managerial posts there was a scale drawn up by the Association of Municipal Engineers and the Electrical Power Engineers Association (and approved by the National Joint Committee of Local Authorities and Chief Electrical Engineers). This scale was not legally compulsory, but there was an agreement to boycott any post advertised at rates below those of the scale. Thus in 1946 a notice was inserted in the Electrical Times stating that a post advertised by Walsall Corporation did not comply with the scale, and that no electrical engineer should accept it. In these circumstances it is not possible to make any meaningful comparison between the wages paid by company and municipal electricity undertakings.

The chief official of a company undertaking was responsible to the Board of Directors, who were themselves, in theory, if not in practice, responsible to the shareholders. In local authority undertakings the gas or electricity manager was responsible to his committee which was itself ultimately responsible to the electorate (not to consumers as such). In both private and public undertakings the effectiveness of management clearly depended

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1. W. Arthur Jones, Electrical Times, Feb. 1946.

on two parts of the line of control - the officials and the Board in the case of companies, the officials and the committee with the local authorities. There was, however, some difference in the relationship between these two parts of the administrative machine. The main differences were (to make a generalisation to which there may well have been exceptions) that the municipal committees were more prone to intervene in the routine matters of administration, while on the other hand they are sometimes supposed to have been more in the hands of their officials. These two points have some causal relationship, since it is in the routine of day to day administration, more than with decisions of policy, that the technical knowledge of the engineer is most likely to carry the day with the laymen on the committee. The decisions taken by the boards of electricity and gas companies have not been studied, but the assumption that they did not normally concern themselves with routine administration appears to be fairly safe. On the other hand examination of the records of business of municipal gas and electricity committees shows that matter was often discussed which can only be described as routine. For example, a considerable number of resolutions dealt with the purchase of quite minor items of equipment. Some committees have sub committees whose

task it was to inspect every account payable by the undertaking. Even the uninformative wording of committee resolutions sometimes show the dependence of the committee on their officials for these routine matters. One gas committee in a typical resolution instructed its engineer to buy a weighing machine and to obtain "the best machine for the purpose". Nobody but the engineer was likely to be in a position to know whether this condition was fulfilled.

Whether, as has sometimes been suggested, municipal committees were more dependent upon their manager than were company boards must remain something of an open question. Quite obviously personalities would affect this, and there could be no general rule applying to all company and municipal undertakings. The general influences which can be determined do suggest that committee boards may, on the whole, have been more independent.

The likelihood that directors would retain their office longer than councillors would give them a greater opportunity to obtain that expert knowledge which would enable them to make independent decisions. It is, on the whole, more likely that some directors would have a background of technical knowledge than it is that councillors would be found with these qualifications. The directors may

also have been more easily able to escape being controlled by their employees because of the more obvious criterion of success available to them. They could normally judge the desireability of a given policy by its estimated effect on the rate of profit. The lack of such a clear cut objective probably made it more common for councillors to be swayed by the arguments of their technicians.

Again speaking in general terms and allowing for individual exceptions it seems likely that the time required for making decisions was less for company undertakings than for those controlled by local authorities. If the previous generalisation that municipal undertakings delegated less authority to make decisions to their officials than did the Boards of company undertakings, then it follows that there would be a greater number of matters in which speedy decisions and quick action were possible. Even for those matters which had to be approved or decided by the boards of companies the company machinery would sometimes have worked more quickly, since all the resolutions of committees had to be approved by the council, and this would cause extra delay for those matters arising in the interval (in many cases not more than a week) between the meeting of the committee and of the council. (It is assumed that boards of directors and councils both

met with the same frequency - usually monthly.) This matter of speed is obviously one in which the qualities of the administrators at both official and committee-board level would be more important than the nature of the decision making machinery.

Part of the efficiency of an administrative machine will depend on scale. The larger undertakings could achieve a greater degree of specialisation amongst their staff. They could also reap the full benefits of indivisible factors of production such as mechanical aids to accountancy. On this count both types of ownership had their own particular advantages. Company undertakings could be made part of a large organisation through the holding company device. This meant that as far as financial organisation was concerned the benefits of scale could be obtained. The special advantage of municipal undertakings was that they could gain some of the advantages of scale by cooperating with other services (both 'trading' and 'social') run by the same local authority. Thus expert legal advice was available in the Clerk's Department, and the Treasurer's Department could provide advantages on the levels both of routine accounting and of financial policy.

One advantage of the municipal control of gas and

electricity undertakings was the possibility of coordination with other services. Where such services as housing, transport, roads, gas, water and electricity were all managed by the same authority there would obviously be room for some degree of coordination in the operation of the services. For example, the electricity and gas undertakings could be aware well in advance of future demands likely to result from the council's housing activities. On a lower plain such activities as the digging up of streets to lay or repair mains could be coordinated. Of course, such coordination could take place between local authorities and companies but it would probably be less effective.

It is also clear that local authorities did not always make full use of their opportunities for the coordination of different services - a fact which was brought out in the Treasury investigation of the administration of Coventry City Council.

The last factor which we may consider in this examination of the administrative machinery of municipal and company gas and electricity undertakings is accessibility to the representations of consumers. In the broader sense of public accountability or the duty to the community as a whole this is considered in the final chapter, but

the actual services with which consumers could effect decisions and make known their grievances may be discussed here. On the whole it would seem that municipal undertakings were more accessible to consumers than were company undertakings, though there is something to be said on both sides. The argument that any lack of consideration of consumers would result in a loss of profit, and that the directors of company undertakings would be more sensitive to fluctuations in the rate of profit than would the members of council committees cannot be said to apply fully in the monopolistic gas and electricity industries. There was, of course, competition, of a quite keen nature in some spheres, between the gas and electricity industries themselves, but it can hardly be argued that this was sufficient to safeguard consumers interests completely. Consumers could not turn from one service to the other as easily as they could alter their taste in tooth paste or soap powder. An electricity undertaking which indulged in frequent supply breakdowns, or wide fluctuations in the voltage of the current it sent out, would no doubt, lose part of its heating and cooking load to the local gas undertaking. But for less serious matters, and in cases of unfair treatment of any kind, the consumer could not get redress simply by transferring his custom to a more amenable

or efficient supplier. It was therefore mainly a matter of chance - of the personalities of the directors, and whether they were local men, which would determine the effectiveness of consumer representation at the level of the board of a company undertaking. (The assumption, which is believed to be realistic, is here made that consumer representation means in practice, the response to complaints rather than the consideration of any positive suggestions likely to be made by consumers.) Consumers had no means of compelling attention to their suggestions or protests.

With municipal undertakings the situation was rather different. Consumers who might never see any of the directors of a gas or electricity company, would see and know something about their local councillor. (Whether or not he was a member of the relevant committee would not particularly matter for this purpose.) What is more they had at least one weapon which would help to ensure that he listened to them - they could vote against him next time he sought election. (The qualification ought perhaps to be made here that the recent growth of party politics in local government has weakened the influence of local events in local elections - but still they cannot be altogether ignored.) It does seem reasonable to assume, therefore, that the average municipal gas or electricity undertaking

was more likely to be responsive to consumers than was a company undertaking. Again the warning must be repeated that there could easily have been exceptions to this generalisation which is based upon purely a priori arguments. Some of the more routine matters connected with relations with the consumer were settled at the level of the officials who met the consumers, and would depend upon their quality rather than on the attitude of the directors or committee members.

Closely connected with accountability to the consumer is the possession by councillors or directors of local knowledge. Knowledge of peculiar local circumstances and needs, what Professor Laski called the "genius of place",[1] can only be gained by living and working in the place concerned. It is evident that local councillors are again likely to be better equipped than company directors in this respect. They are bound to have either residential or business connections with the area concerned, and were usually people who had lived in the area for many years, often, indeed, all their lives. This might also be true of the director of a gas or electricity company, but there was no guarantee that he would have any direct

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1. Laski, Grammar of Politics, p. 410 et seq.

connection with the area at all. In fact, in the cases of many of the smaller companies, the directors were local men, but with the bigger company undertakings these local connections very often did not exist except by accident. The growth of holding companies, often having the same directors on the boards of a large number of subsidiary companies, and with ultimate control in the hands of the holding company board, the influence of local knowledge could not be great. Two examples from the gas industry may be cited here to illustrate the impossibility of some directors having any real local knowledge of the districts peculiarities in which the companies of which they were directors were situated. Two of the directors of the South Western Gas & Water Corporation, a holding company directly controlling 29 gas and water companies before nationalisation, were Mr Rosewarne and Mr Whittington. Mr Rosewarne was also director of the Bude, Camborne, Falmouth, Lostwithiel, Newquay and District, Okehampton, Padstow & St Columb, St Austell, St Blazey, and Truro has companies. Mr Whittington was director of the Aberdare & Aberaman, Aylesbury, Bedford District, Dorchester, Dursley, Glastonbury and District, Leighton Buzzard, Llanelly, Merthyr, Midsomer Norton, Rhymney & Aber, and Wells Gas Companies, as well as of the U. K. Gas Corporation and

four other companies.

To summarise this comparison of the administration of municipal and company gas and electricity undertakings certain general points may be repeated, though all of them are likelihoods rather than certainties and admit of many exceptions. It seems likely that company undertakings could obtain the best men at the highest level because they were willing to pay larger salaries for their posts. On the director - councillor comparison it may be said that councillors were more prone to consider routine matters of administration and were more likely to have a local knowledge and to be available and accountable to consumers than were directors. Technically qualified men were more likely to be found amongst the ranks of directors than of councillors. Comparing the actual machinery of administration the municipal system allowed for some scale advantages and for the possibility of coordination with other services whilst the company administrative machinery would normally function with greater speed.

It is evident that all these considerations are not of equal importance. Indeed some of them may be of little or no significance at all in operation of gas or electricity undertakings. In order to investigate this matter further

certain actual business done by a number of gas and electricity committees was studied. Table 171 shows the subjects of the decisions made in the periods studied, and the number where more than one similar resolution was passed.

Table 171. Decisions and Resolutions made by the Committees of Municipal Gas Undertakings[1]

Subject of decision	No. of decisions made
Allocation of profits	1
Allocation of management charges	1
Consideration of Engineer's Report	2
Provision of public lighting	2
Purchase of new equipment	9
Repairs to equipment and premises	4
Continuation of Tar Pool Agreement	1
Agreement with railway on cost of repair of gas works siding	1
Alteration in salary scales	1
Change in constitution of Committee	1
Staff appointments	6
Applications to borrow capital	4
Advertisement of staff vacancy	2
Grant of use of land	1
Extension or enlargement of mains	2
Alteration in working hours	1
Changes in tariff	3
Exceptions to Council's Standing Orders about the acceptance of Tenders	1
Payment of cost of gas mains to new housing estate	2
TOTAL	45

1. One Urban District - 2 years 8 months period; one County Borough - 2 years period; one County Borough - 1 year period.

Table 172. Resolutions made by Municipal Electricity Committees[1]

Subject of resolution	No. of resolutions
Works report	3
Use of profits	3
Coal supplies	4
Bulk supply agreement	1
Extensions of mains	12
Allocation of management charges	1
Erection of sub-stations	3
Salary scales	1
Purchase of land	3
Change in constitution of Committee	1
Purchase of equipment	9
Staff appointments	2
Tariff changes	2
Travelling allowance to employees	1
Free lighting of public buildings	2
Application to borrow capital	1
Election of representative on District Industrial Council	1
Resolution on Purchase Tax on electrical equipment	1
Agreement on street lighting	1
Total	52

The statistical analysis of the resolutions passed cannot be pressed very far, since it is obvious that the mere number of resolutions passed does not necessarily give any indication of the importance of any one type of decision. One decision on a change in tariffs may obviously be more

1. One County Borough - 2 years; one Urban District - 2 years 8 months; one County Borough - 6 months.

important and significant than a number of decisions on the purchase of equipment. The following analysis attempts to show the extent to which the decisions made by the committees investigated appeared to demand four of the special 'qualities' mentioned above - two in which the municipal system was considered to have the advantage (local knowledge and coordination) and two in which company undertakings were more likely to be favourably placed (speed in making decisions and technical knowledge of directors).

Table 173. Qualities and knowledge relevant to the decisions made by the committees of municipal trading undertakings

Decision	Local knowledge	Coordination	Speed	Technical knowledge
GAS				
Consideration of Engineer's Report	-	-	-	x
Provision of public lighting	x	x?	-	-
Purchase of new equipment	-	-	-	x
Tar Pool Agreement	-	-	-	x
Grant of use of land	x	x	-	-
Extensions of mains	x	x	x	-
Changes in tariff	x	-	-	-
Cost of gas mains to new housing estate	x	x	-	-
ELECTRICITY				
Consideration of Engineer's Report	-	-	-	x
Bulk supply agreements	x	-	x?	-
Extensions of mains	x	x	x	-
Erection of sub-stations	x	-	-	x
Purchase of land	x	-	-	-
Purchase of equipment	-	-	-	x
Changes in tariff	x	-	-	-
Free lighting of public buildings	x	-	-	-
Provision of public lighting	x	x?	-	-

Note: x signifies that the 'quality' in that column applies to the decision, - that it does not. x? signifies that there is some doubt or qualification about the relevance of the quality concerned. Decisions for which none of the 'qualities' appears to be relevant are omitted from the Table.

The classification in the above Table is somewhat tentative, and does not apply to all the decisions which are made under each heading. For example, a decision on public lighting might be a purely routine matter of approving some long-standing practice, and not require any special 'qualities' at all. The position is examined more fully in the following consideration of the position of individual services. The division between the different 'qualities' themselves is not rigid in each case. This is particularly true of the distinction between ability to coordinate with other services and 'local knowledge', since the former might often be an aspect of the latter.

With the gas industry 'local knowledge' was considered to be relevant for 5 types of decision, coordination for 4 (including 1 doubtful), speed for 1, and technical knowledge for 3. The main details of an Engineer's Report, such as total output and sales did not need any special technical knowledge to make them comprehensible. There were other details which were included in some reports, however, which could not be fully understood without at least a small knowledge of the technical problems of gas manufacture. Most important of these were statistics relating to the efficiency of the plant, such as those showing the gas made per ton of coal carbonised.[1] This is a point of some

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1. E.g., County Borough of Walsall, Annual Report, 1946-7.

importance, since, if the assumption that councillors generally lacked this minimum of technical knowledge, is correct, then it means that they were not in a position to know whether their works were being operated with reasonable efficiency (in comparison with those of other undertakings). It has already been shown that price comparisons are an uncertain indication of operating efficiency, and councillors could not therefore fall back on these for guidance.[1] It seems likely that most committees were very much in the hands of their chief officials in this matter, and not in a position to form an independent judgment on the efficiency of their undertaking.

Most of the decisions relating to public lighting in the sample studied were fairly routine. The main points at which local knowledge and coordination would seem to be appropriate were in extending lighting to newly developing areas. The purchase of new equipment is perhaps the most obvious case in which some technical knowledge would appear desirable. Without this knowledge committees must have depended entirely upon the judgment of the engineer. The case already cited of a resolution instructing a gas engineer to buy a weighing machine and to obtain "the best machine for the purpose" was an example of this. Some

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1. Cf. p. 219 et seq.

technical knowledge would also appear to be useful in approving agreement made about a Tar Pool (for the selling of coal tar). In making grants of the use of land to other services some local knowledge, and ability to coordinate, would have been useful. In fixing tariffs, local knowledge would appear to be the most important and relevant factor (apart of course from general administrative ability and business sense which is excluded from consideration at present). Local knowledge of the needs and demands of local industry must have been particularly useful in fixing industrial tariffs and, as many undertakings did, in arranging special tariffs for individual works. The most important application of local knowledge was, almost certainly, in the extension of supply mains, with which may be linked the special problem of allocating the cost of gas mains between the housing and gas departments. Coordination with other services must also have been important here. The extension of mains often needs to be planned ahead of new industrial or housing development, and the provision of the different utility services must be coordinated.

The relevance of the different 'qualities' to decisions made by electricity industries was as follows - Local knowledge - 7, Coordination - 2 (1 doubtful), Speed - 2 (1 doubtful), Technical knowledge - 3. The position in

relation to the Engineer's Report, bulk supply agreements, purchase of equipment and changes in tariff was similar to that for gas. The extension of mains and providing of extra supplies was a matter in which local knowledge and coordination with other services was often of particular importance. This was especially true in industrial areas where local needs could change quite rapidly. A feature of the resolutions of the electricity committee of one industrial county borough were the approval of extensions to meet new factory development, and provisions for increasing the supplies to existing works. An example of coordinated action which might have been missed with a different administrative set-up was the resolution of one electricity committee to use the opportunity of the paving of a road to lay electricity cables. Local knowledge (in choosing a site particularly) and technical knowledge may have been appropriate in decisions relating to the building of sub-stations. Local knowledge would obviously be important in making decisions on the granting of free lighting to public buildings.

Although local knowledge was certainly a useful quality in the administration of gas and electricity supply it is probably true to say that it was less important than with some other municipal services. With road passenger transport in particular, awareness of

local needs is especially important.

In concluding this examination of company and municipal administration some mention must be made of part of the municipal system which has, so far, been largely ignored. The Council itself, which appoints the committees and has to approve their decisions, has some part in the pattern of municipal administration of gas and electricity undertakings. The following Table (174) shows, for two county boroughs and one urban district, the number of occasions when committee reports were adopted without alteration, and those when there was some alteration made, or some instruction given to the committee. For purposes of comparison the decisions of other 'trading' committies are also included.

Table 174. Treatment by Councils of the reports of Committees of 'trading' undertakings.

Committee	Number of reports in sample.	No. accepted unchanged.	No. not accepted unchanged
COUNTY BOROUGH A.			
Navigation	2	2	-
Market & General Purposes	3	3	-
Transport	3	3	-
Electricity	3	3	-
Estates	3	3	-
COUNTY BOROUGH B.			
Markets	23	21	2
Transport	23	23	-
Electricity	23	23	-
Water	23	23	-
URBAN DISTRICT			
Gas & Electricity	16	11	5
Gas	5	4	1
Electricity	4	2	2
Civic Restaurants	11	9	2

The first conclusion which can be drawn from the facts in this Table is that they support the generally accepted belief that in the great majority of cases Councils do not interfere with the decisions of committees. The figures shown relate to reports, each of which usually contained a number of resolutions, but the number altered by Councils in any way was very small. The second conclusion is that there is no noticeable difference between the different committees in this respect, but that one authority shows

a larger number of 'alterations' for all committees, than the other two. Since this is a matter which must vary considerably with the personalities of councillors and the accidents of local politics, it would, however, be dangerous to generalise, even on the basis of a much larger sample. It is perhaps significant that the two county boroughs were divided on party lines, whereas the urban district had no rigid party organisation. The existence of party organisation and discipline is likely to make it easier for the majority party to make sure that committee decisions are accepted by the council. In order to discover the kind of issue on which councils did interfere with the decisions of committees, it is necessary to examine the details of the 'alterations'.

The two 'alterations' in the report of the Markets Committee of County Borough B both related to the same resolution. The Committee wished to eliminate infringements of their market rights by a stricter control of licences. This involved preventing traders from selling goods in the streets. The traders mainly concerned were the flower sellers, and they were to be confined to the Corporation market itself. This proposed banishment of flower sellers from the streets caused something of a popular outcry. The flower sellers presented a petition to the Council, and the Report of the Markets Committee was referred back.

The Committee decided to restrict the ban to the streets immediately surrounding the market, and this compromise was accepted by the Council, with the added condition that any trader should have a right of appeal against the decisions of the Committee. This seems to be an example of the useful working of the Council's power of veto in an exceptional case, in which the decision of the Committee, concerned only with the prosperity of the market, overlooked other implications of its decision, which would harm the interests of flower sellers, and, as was pointed out by objectors, make the town less attractive by removing one of the few remaining evidences of the countryside. One Report of the Water Committee of this county borough, although it was eventually accepted unchanged, did cause considerable debate in the Council meeting. This was on the controversial issue of the 'Closed shop'. The Resolution of the Water Committee provided for the excusal of three workmen from the requirement to join a union. This resolution was used by some councillors as an opportunity to attempt to abolish the 'Closed shop' rule altogether. This is, of course, an issue which is usually a 'party' matter. Some of the 'alterations' made by the Urban District Council were more routine and were more reconsiderations by members of the appropriate committee of their own decisions, than the alteration of those

decisions by councillors who were not members of that committee. The 'alterations' made by the Gas & Electricity Committee were:- the addition of a recommendation on the payment of the expenses incurred by the Gas Manager; the instruction (relating to a resolution to prepare public lamps for the resumption of street lighting) that only 60% of public lamps should be lit; an instruction on the payment of an indemnity to the Great Western Railway for repairing the sidings belonging to the gas undertaking; an instruction to carry out further discussions with the Electricity Commissioners on a scheme to take further bulk supplies of current; and the referring back of a resolution relating to the appointment of a chief clerk. A resolution of the Gas Committee (after the Gas & Electricity Committee was divided) about the pension of a retired clerk was varied (being made more generous); and the Electricity Committee was instructed to reconsider the choice of a site for the erection of a sub-station; and to consider the use of sirens for fire-warnings. The Civic Restaurants Committee was instructed to send a copy of its accounts to every member of the Council; and the resolution approving a wage increase for a cook was referred back. Thus this Council, despite the qualification mentioned above, showed a greater readiness to interfere with its Committees, particularly in matters

relating to the staff, than those of either of the County Boroughs. In smaller councils without any party discipline there tend to be certain matters which will always raise some degree of opposition in the Council. In the case of the Urban District quoted, an examination of the records over a longer period than that shown in the Table indicated that the conduct of the business of the Civic Restaurants was frequently a matter for debate, as some Councillors appear to have been opposed to the very existence of the restaurants.

Requests and petitions which related to the operation of trading services could be laid before the Council, but these were generally referred to the committee concerned. For example, a request to a County Borough Council for improved bus services in one part of the town was referred to the Transport Committee. When decisions of a 'trading' committee involved the raising of capital it was usually necessary for them to obtain the approval of the Finance Committee, and often also of a government department (The Electricity Commissioners in the case of the pre-nationalisation electricity industry) and this provided an important control over the activities of committees and probably considerably reduced the number of occasions on which it was necessary for the Council to interfere with decisions.

Generally speaking it may be said that the function

of the whole Council was to intervene only where the gas or electricity committee took some action which had political repercussions or aroused some unexpected public reaction.

CHAPTER 5.

Conclusions.

In these conclusions the main results of this investigation of company and municipal ownership in the gas and electricity industries are summarised and then their significance in relation to other forms of public enterprise is discussed.

The development of the gas and electricity and of the other public utility industries in the nineteenth century illustrates that pragmatic approach to problems of government which is supposed to be typically British. With the growth of the gas and water industries in the new towns created by the industrial revolution it became apparent that unrestricted private enterprise would not meet the needs of the community adequately. (The lesson was later applied to the newly-developing electricity supply industry). Because free enterprise did not work in these industries and because the services supplied were of an essential nature some action had to be taken. This action was to control existing private undertakings and to allow public bodies, mostly municipal borough councils, to provide supplies. The main reason why unrestricted private enterprise did not work in the gas and electricity industries was that the techniques of supply made them into natural

monopolies. But there was a second reason which was more obvious with water supply than with gas and electricity but was present to some extent with all the public utility industries. This relates to a defect of private enterprise itself, whether under perfect competition, monopoly, or any intermediate state, when it deals with services of an 'essential' nature. There are sometimes groups of people or individuals who, because of their income level or their geographic location, or for some other reason, provide an unattractive market to those who are guided only by the profit motive. This second factor, that some would-be consumers will not provide a profit and therefore will not be supplied by private enterprise motivated only by the desire for profits is one of the factors leading to the blurring of the division between 'social' and 'trading' services.

The investigation of the difference between 'social' and 'trading' municipal services showed that there was no really valid distinction between the nature of the services provided except in the one issue of finance. Distinctions which refer to some activities being of an 'industrial' or 'economic' nature have no very sound logical basis, and it was in the decision as to whether or not a particular enterprise should be financially self-supporting that the

real difference between 'social' and 'trading' services was found. Even in a service which was not dependent upon tax support something of the character of a social service could be introduced by the subsidisation of some consumers at the expense of others. As soon as the possibility of considering the needs of the consumer, and refusing to be guided solely by his ability or willingness to pay an 'economic' price, arises, then even the most obviously 'industrial' or 'trading' enterprise may be run in a similar manner to a social service. The implications of this point are worked out more fully below in the consideration of the purpose of public enterprise.

The conclusions of the central part of this study on comparable levels of efficiency may be expressed in the broadest terms by saying that the company undertakings reached a slightly higher average level of operating efficiency while the municipal undertakings sold gas and electricity more cheaply to consumers.

In the gas industry, samples of company undertakings were found to have a very slightly higher average level of thermal efficiency than their municipal counterparts. This remained true even when allowance was made for variations depending upon size. In fact there were rather more muni-

cipal undertakings falling into the optimum low cost size group. The evidence relating to the selling price was more definite and unequivocal than that relating to operating efficiency. The average prices charged were lower for all large samples of municipal undertakings than for those operated by companies. This was true both for the prices charged to domestic and to industrial consumers. A consideration of factors other than the form of ownership which might influence the level of prices - incidental charges; regional variations in fuel costs; and size; indicated that none of these could account for the lower average price level of municipal undertakings. (There was some evidence that municipal undertakings were, on the whole, more favourably placed in relation to fuel + transport costs).

In the electricity industry the picture was generally the same, though there were considerable differences in detail, and the activities of the Central Electricity Board introduced a complicating factor not present in the case of gas. The advantage in operating efficiency of the company owned generating stations was greater than the corresponding advantage of company gas undertakings. This advantage was apparent both in comparisons of the thermal

efficiency of stations and with that of generating costs. Allowances for variations in fuel costs, size, and load factors did not make it necessary to change this conclusion. The average selling price of current both for domestic and industrial purposes was lower for all samples of municipal undertakings than for those owned by companies. That this was not the result of different fuel costs, more favourable size, or better load factors was demonstrated by a study of the relationship of the actual cost of the current to each undertaking (that is the price paid to the Central Electricity Board for the purchase of energy), to the selling price. This showed that the average difference between the selling price and the 'grid' purchase price was considerably less for municipal than for company undertakings. The explanation of this ability of municipal undertakings to sell both gas and electricity more cheaply, even with higher production costs was found when the financial policies of the two types of undertakings were studied.

A study of the financial policies of municipal and company gas and electricity undertakings, showed that the results of the two types of ownership were sufficiently different to enable the municipal undertakings, despite the generally poorer showing of their undertakings as regards operating efficiency, to supply consumers of gas and elec-

tricity (both industrial and domestic) at distinctly lower average prices than their company counterparts.

A study of both gas and electricity undertakings showed that in the period investigated the company undertakings were paying around 6% on all outstanding capital (Loan and Ordinary) while local authorities were on the average only paying about 3% on their outstanding loans. There were two distinct reasons for this state of affairs. Firstly, the security of the rate fund gave even the smaller local authorities the ability to borrow at rates of interest available only to the largest company undertakings. (This position was exaggerated during the post-war period by the action of the Public Works Loans Board in lending to local authorities at rates below those they would have had to pay on the open market). Secondly, the company undertakings had no incentive to reduce the payments on that part of their capital which was in the form of Ordinary shares. In their case an increase of dividends rather than a reduction of payments was taken to be a sign of success. Thus even those larger companies which could borrow loan capital at a rate approximating to that paid by local authorities did not raise all their capital in this way because of the fundamentally different position of a joint stock company,

existing to benefit the shareholders, and a public enterprise, existing to meet the needs of consumers.

The lower 'total capital charges' of the municipal undertakings were not only the result of the ability (whether by choice or not) to borrow at a lower rate of interest. It was shown that in an investigation of the electricity industry the advantage in having lower 'total capital charges' was greater when calculated in relation to the units of electricity supplied than it was in relation to the amount of capital outstanding. In other words, local authorities did more to reduce the amount of outstanding debt than did companies. This again was a result of the different nature of the enterprises. This fact remained true when allowance was made for payments to depreciation and reserve funds of various kinds. Incidentally when all the factors were taken into consideration no real evidence was found for the contention that municipal trading undertakings did not make proper allowance for depreciation. Another way of looking at the differing positions of municipal and company undertakings was to examine the disposal of the gross surplus. In all the years examined, except for the abnormal year immediately before the nationalisation of the electricity supply industry, the companies were paying out around 50% or more of the gross surplus while local auth-

ority undertakings were only transferring to those outside the undertakings about 30%.

We can now consider the significance of these differences in the financial policies and practices of company and municipal undertakings, differences which have proved to be the chief practical result of the differing forms of ownership. In effect the municipal undertakings were apparently financing themselves more cheaply than company undertakings because the public type of organisation provides for the risk bearing function at a lower cost. If we think of the variations in the rates of interest or dividends paid as depending on the variations in the degree of risk borne, then we get the well known result, in the case of company undertakings, that loan capital which bears the least risk is given the smallest reward, whilst the owners of ordinary capital, bearing the greatest part of the risk of the enterprise are given the largest proportional reward. In municipal undertakings all the issued capital was equivalent to debentures and the slightly lower interest rates paid were, as already stated, made possible by the security of the taxing power of local authorities.

The next question which must arise from this is the actual weight of the burden of risk bearing. Did the ratepayers and shareholders in fact have to face periods of loss

or not? An examination of the financial record, mostly of electricity companies shows that losses were very much the exception. This is of course what would be expected with a monopolistic industry providing an 'essential' service. During normal times the burden of the risk in either the gas or the electricity industry is very small though of course future developments might change this situation. (The development of an alternative source of power and heating such as atomic energy could make investment in gas or electricity plant largely valueless). But in the situation which has so far existed it does seem that it may be concluded that there was no real burden on the ratepayers of local authorities which operated gas or electricity undertakings. In other words, it can be said that the shareholders of company undertakings received an excessive reward for the duties which they performed. (Excessive, that is, in relation to what was strictly necessary - no value judgment on the level of reward to investors is intended). The lower 'total capital charges' of municipal undertakings did not imply any real saving of resources. What it did do was to favour one class of the community, those who consumed gas and electricity, at the expense of another class, those who lent capital to these industries. How far this income transfer effect was desirable must

depend upon some unknown factors such as the use to which these classes would put the amounts of income of which they were deprived, or which they were given, by differences in company and municipal financial practice. It is of course obvious that the transfer from 'lenders of capital' to gas and electricity consumers would be a movement towards the more equal distribution of income.

The main lesson of the investigation of the effect of ownership on location was that municipal ownership did in some cases result in the location of gas manufacture and electricity generation, more particularly the latter, different from that which would have resulted from a consideration of the economic factors only.

It is a peculiar problem of public ownership that it is likely to be subject to political pressures in planning the location of new industrial development.

The examination of the administrative patterns of municipal and company gas and electricity undertakings showed that both asked for more or less the same qualifications from their staff, but that the companies paid, on the average, rather more to their chief officials. Some of the larger companies were prepared to appoint managers who did not possess technical qualifications. The company type of administrative machine seemed more likely to make speedy

decisions and actions possible, while the chief advantage of municipal administration lay in the local knowledge of the councillors, and their contacts with consumers. These conclusions clearly do not necessarily apply to other forms of public ownership. (1)

We have now reached the point where these conclusions can be rounded off and this study completed by applying what has been learned about the records of public and private ownership in the gas and electricity industries to the future; the future that is of municipal 'trading' and of the state ownership of 'industrial' enterprise. Looking back at the comparative records of these two industries under controlled private and under municipal ownership it is impossible to be very partisan in supporting either type of ownership. The extravagant and politically inspired attacks on what has been called municipal socialism were quite clearly not justified. The local authorities on the whole have done a sound and competent job in the provision of gas and electricity supplies. But on the other hand company undertakings, prevented by the state from abusing their monopoly position, have also operated satisfactorily.

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(1) For their relevance to a discussion about the different forms of public ownership see pp.

Generally speaking, the operating efficiency of company undertakings was slightly higher in both industries. The only real achievement of municipal enterprise, if achievement is the right word for a result which came about more automatically than with conscious effort and planning, has been what may be called the elimination of profit. Gas and electricity consumers have benefited from municipal ownership where local authorities have borne the risk of enterprise at less cost to the consumer than have company undertakings.

It is not relevant here to do more than mention the more general arguments for public ownership which can apply to municipal trading but which nowadays are used mainly to support nationalisation. These arguments are that for some special reason private enterprise is not working properly in a particular industry (because of monopoly conditions or its opposite, cut-throat competition); in order to bring about a more equal distribution of income; or the desire to control industry and thus make possible the planning of the nation's economy. There are four arguments more relevant to a growth of municipal trading enterprise. Firstly, there is the contention that certain industries are unattractive to private enterprise, or have been for some reason neglected, and that these services should therefore

be supplied by local authorities. The wartime development of Civic Restaurants was a case in point. Now that the special wartime need for this type of communal restaurant has disappeared we have the interesting position that there is a local authority service competing on more or less level terms with private enterprise. Private enterprise can and does compete with the remaining municipal restaurants in the provision of such low cost catering services as are still required in peace time.

Closely allied to this possible reason for a future growth of municipal trading enterprise (a field which must be very restricted as initiative in starting new and financially risky enterprises cannot be said to be the strong point of municipal or any other form of public ownership) is the probably more fruitful sphere of those services which are on the border line between being of a 'trading' and of a 'social service' nature. This applies to many present municipal activities in the sphere of entertainment. Some of these entertainment services could be provided by private enterprise but the possible rewards are not great enough to make widespread private provision likely. With these services (municipal orchestras, swimming pools, etc.) there may be a financial return to the town in the form of money spent in its shops and restaurants

which would not show up in the accounts of the particular undertaking itself. Then thirdly we have those services which are trading or self-supporting, but which are closely connected with some other distinctly social service activity and develop from it. An interesting example is the extraction of grease from the waste of woollen mills in Bradford and Morley - a development from the social service of sewage disposal. To some extent this applies to Civic Restaurant services which are often run in conjunction with the social service of providing meals to school children. A last argument for the extension of trading in the municipal sphere is the desire to strengthen and encourage local government for its own sake. Most students of government would agree that local democracy does serve a most useful purpose in itself by providing many more people than could hope to enter Parliament with the chance to play some part in the political life of the nation. It may possibly be argued in the future that certain services of a trading nature should be entrusted to municipalities not because they do them particularly well, but because local authorities do need some functions if they are to continue to hold any interest for people or to be in any sense training schools for government. Of the possible reasons for a

future extension of municipal ownership the most likely is that the services are of a semi social service nature.

This brings us to the question of what particular features we must look for in any industry which might be considered as a candidate for municipal ownership. Firstly, there must be no economies of scale which cannot be reaped by the fairly small unit which local municipal control necessitates. Not only must there be no economies of scale which are to be lost at the time of the transfer to public ownership but also the possibility of technical changes making necessary a larger scale of operation than that which most local authorities can provide must be considered. The history of the electricity industry in this country provides a very clear example of the lag in development which may occur when an industry is cast into a rigid mould which cannot readily be changed to meet changed technical conditions. Secondly, the industry must be suitable for the municipal type of administration. To say precisely what this means would entail a far more thorough study of municipal administration and its potentialities than has been made here. Just what services a local authority could administer satisfactorily if it were given the opportunity, is one of those hypothetical questions which cannot be answered with certainty. It can be reasonably

argued, however, that there are some industries whose nature clearly makes them unsuitable for municipal ownership, or for the municipal pattern of control. Dealing with the organisation of London's transport services, Mr. Herbert Morrison, in spite, or perhaps because, of his experiences with the London Country Council, wrote that "....it is not certain that such a huge commercial enterprise would be appropriate as part of the ordinary machinery of local government."(1) Those industries which are necessarily of a competitive nature, which depend upon changing consumer tastes, either in the home or export market, would appear obviously unsuitable for municipal administration. Thirdly we may turn from these negative statements to a positive one. Those industries where local knowledge is important are particularly suitable for municipal control, other things being the same. With neither of the industries dealt with in this study is it possible to argue that this local knowledge is especially important. It was no doubt useful where it existed before nationalisation, but it is difficult to see any great differences between the needs of gas and electricity consumers wherever they might live.

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(1) Morrison. "How Greater London is Governed." p.130.

This point must be distinguished from the question of consumer relationships which is closely allied to it. The distinction is somewhat fine, of course, but it is there. There is a difference between trying to meet the needs of, and dealing with, the complaints of consumers in general and between seeking to adapt a service to the special requirements of local or regional groups. The local authority may have been better placed to do both of these things but its advantage in the second respect is more important since the representation of consumers on a national level should be possible even though at the moment the problem has not been solved.(1) It seems likely that in the road passenger transport industry this adaptability to local conditions and peculiarities, which may themselves change quite rapidly, is much more important than in the relatively homogeneous gas and electricity industries. A matter which profoundly affects these speculations on the future of municipal trading activities is the reform of local government areas and structure. A rationalisation of local government boundaries would greatly improve the chances of enabling them to partake in the provision of this type of service.

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(1) See for example the discussion of this problem in the Political Quarterly, July-Sept.1953. "Consumers' Councils in the Nationalized Industries". - Sargant Florence and Maddick.

Some consideration may now be given to those more general issues arising from this study which apply to state as well as to municipal public enterprise and to other industries besides gas and electricity supply. The main issues concerned are:- the problem of consumer relations, the significance of financial procedure, and the question of the difference of purpose of public and private enterprise (including the problem of the deliberate making of a loss by a publicly owned undertaking).

The policy of nationalisation weighed the scales heavily in favour of optimum size for technical operation, and while there is no real doubt that this should be the overriding consideration, relationships with consumers and knowledge of local needs are by no means without importance. So far the nationalised industries have found nothing to replace, what was perhaps rather taken for granted under municipal ownership, the ability of local consumers to contact their local councillor, whom they could know, whenever they had any request or complaint to make about the relevant service. It would be possible to argue on this count that the distribution of gas and electricity could be returned to the hands of reformed local authorities. Mr. I.M.D. Little, in his recent book on fuel policy,[1] argues in favour of the return

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(1) Little, "The Price of Fuel", pp.129-30.

to local authorities of the duties of selling appliances, wiring or laying pipes inside premises, reading meters, sending out accounts, and collecting payments. (Though his suggestion that there would be advantages in the joint rendering of accounts is debatable since it is possible to reap economies of scale in the shape of mechanical accounting and the continuous use of staff when this job is done in an area the size of that of a regional gas or electricity board, which would be lost in the relatively small area of most local authorities).

There are really two distinct problems arising from the ability of a public body to borrow more cheaply than a private undertaking and from the elimination of the divisible profit. A problem which has emerged in national public undertakings, and which has received some attention from economists, is that of the implications of the Treasury guarantee in making it possible to borrow at the same rate of interest for very different purposes. Since, however, this point does not arise directly from a study of municipal public enterprise (though it was true in a much more limited sense of the activities of local authorities) it need not be discussed here in detail. The only point which perhaps is worth making is that the suggestion that the artificial equalisation of interest rates for investment for different

purposes was bad, because it does not enable the market to make a judgment on the different degrees of risk involved (and by implication of the desirability of alternative forms of investment) is based on the assumption that investors are competent to judge between alternative lines of capital expenditure. If it should be accepted that investment can be planned more effectively by the state than it can be determined by the market, then of course these objections to the effects of the Treasury Guarantee largely fall to the ground. In other words it is not relevant to use arguments relating to a 'free' economy, to one which is, in this particular, planned.

The second point which is more directly connected with the study of municipal enterprise, and which certainly applies to state public enterprise as well, is the consequences of the adoption of risk bearing and the abolition of the distribution of surplus which results from public ownership. If we consider the whole range of nationalised industry then the position is a little more complicated than it is when we look only at the gas and electricity industries. Where there are no losses to be met, which may be taken to be the normal state of the gas and electricity industries at present, then, as has already been

pointed out, the result of public ownership is in effect an income transfer from lenders of capital (there is no really adequate word to describe this class of people since the word 'capitalist' has acquired a rather misleading connotation) to the consumers of the products of the service or commodity concerned. On the whole, this result appears to be desirable at least so long as we assume that under present conditions a more equal distribution of income (which does not have any really adverse effects on the 'lenders of capital') is to be desired. For any commodity or service which is in widespread demand this is likely to be the result of the lower public interest rates. If public ownership was to extend to luxury goods which were consumed only by the upper income groups, this would of course no longer remain true. Indeed, in the unlikely event of the public supply of a commodity consumed by a group of people smaller in numbers and richer than the group of those who lend capital, the result of public financial policy would be to make income distribution less even amongst the relatively small number of people concerned. If we press the analysis of the results of public ownership on income distribution, then it becomes evident that this picture of a transfer from capital lenders to consumers is not quite

the whole story. There may also be some transfers within the group of lenders of capital. The simple transfer only takes place if those who held the shares in a company undertaking before it passed into public ownership now hold corresponding government stock. This may of course not always be so, since those who invested, for example, in the Ordinary shares of an electricity company, may not be content to hold British Electricity stock instead, but may switch their holdings into some other joint stock enterprise. But to follow these movements must take us into the field of conjecture, and since the transfer of an industry to public ownership does mean the replacement of large holdings of shares by government stock for the 'lenders of capital' as a group, then the broad picture of this type of income redistribution must remain true.

Where as in some of the operations of the British Transport Commission a persistent loss occurs, then the taxpayers as well as consumers and lenders of capital are brought into the income redistribution pattern. The precise nature of this redistribution depends upon the terms of compensation to the former shareholders in the nationalised industry, and upon the pattern of taxation. Assuming the kind of compensation that has been common in this country, with the issue of fixed interest government stock,

then a persistent loss entails an income transfer from taxpayers to the 'lenders of capital' class. Whether or not this would be a movement towards the less even distribution of income depends upon whom the extra burden of taxation necessary was made to fall. It might be that with just the right degree of progressiveness in the taxation system there would be no appreciable redistribution at all. The result could be just a case of "out of one pocket into another". The position of the consumer in this situation depends obviously upon pricing policy. It may well be that in this instance public ownership entails a higher price to the consumer (if he is expected to bear part of the burden of the fixed interest stock) than he had to pay under private ownership. This would, however, be only a short term effect: Private enterprise would not have continued to bear a loss indefinitely and so under private ownership the service or commodity would either have ceased to exist (or the commodity to be supplied) or the price would have risen. It is possible though that the short run in this context might have covered a period of a number of years. A company could, as many did, continue in existence for a considerable time, without paying any return to the holders of Ordinary or indeed of Preference and Debenture shares.

It is this disappearance of the willingness to accept no reward at all in bad years which means that public risk bearing will not always be of advantage to the consumer.

Lastly we may turn to the fundamental and yet rather neglected question of purpose. Most of the controversy about public and private ownership has centred around the issue of efficiency (that word being used in approximately the same sense as that given to 'operating efficiency' in this study.(1) The instructions given to the new Public Corporations in the nationalisation legislation do not go very far beyond this limited conception of purpose. The Electricity Act of 1947, for example, imposes on the British Electricity Authority the duty of attempting to "develop and maintain an efficient coordinated and economical system of electricity supply".(2) Since the achievement of a high level of operating efficiency is obviously a common purpose of both public and private enterprise this has tended to hide the fact that in other less important, but by no means insignificant ways, their objectives may differ.

Although modified by government controls, or by the fear of controls, and by its own 'social conscience' it is

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(1) cf. p.210.

(2) Electricity Act, 1947, 10 & 11, Geo.6., Ch.54, Cl.I.

still true that private enterprise can decide most issues by the relatively simple criterion of the ultimate effect on profits. Public enterprise is in a very different situation. In some ways it is bound to meet considerations of welfare and to have to make some value judgments. Even if a public enterprise decides to stick rigidly to a policy of full average cost pricing it will still act in some ways in a different manner from private enterprise. Instead of considering the financial well-being of shareholders, public enterprises must make the welfare of workers, consumers and the community as a whole their concern.

There are two main ways in which this basic difference in purpose might be expected to have practical results in the actual formation of policy. These are in labour relations and in what may go under the general heading of 'finance'. (The different aims of public and private ownership might also result in different policies towards location and the level of investment in the industry concerned. Even the limited investigation of municipal and company ownership in the electricity industry made in this study produced some evidence of 'political' considerations which may influence public enterprise in making location decisions. But both location and investment policy have now largely become matters which are decided outside the industry concerned.

In so far as the state has taken over the guidance of the location of new industrial enterprise and the determination of investment priorities this means that the motives of public ownership will prevail in these respects, whatever the form of ownership may be). In fact this study did not show any significant difference, in their attitude towards employees, between the publicly and privately owned sectors of the gas and electricity industries. When we turn to the broader sphere of public ownership in general, there are, of course, a number of problems connected with labour relationships, such as the position of trade unions in the nationalised industries, and of the existence of possible political pressure which did not develop in the limited area of municipal ownership. But to say any more about these issues would be to go outside the scope of this study.

The main issues relating to financial policy which have already been discussed in these conclusions are the actual differences between company and municipal practice in the gas and electricity industries[1] and the significance of these differences in the whole sphere of public enterprise[2] Under the present discussion of purpose a further point arises:- when may a public undertaking decide to cross the border

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(1) Cf. pp.434-439.
(2) Cf. pp.448-453.

between a 'trading' and a 'social' service[1] in its pricing policy, and deliberately fix prices which are below the cost of supply?

In the basic matter of the relation of the charge made to consumers to the cost of supply, there are two ways in which the 'social purpose' of public ownership can lead to a departure from the practices of private enterprise. The industry as a whole may be subsidised from tax revenue, and, even where an overall surplus is achieved, some classes of consumers may be favoured in relation to others by a form of cross-subsidisation. The Acts setting up most Public Corporations lay down that a net surplus of total income over total expenditure must be achieved whenever possible. This means that there is no immediate possibility of a subsidised supply of gas or electricity, or even, when it can be avoided, of transport services. But the record of municipal 'trading' shows that the borderline between a wholly self-supporting and a partly subsidised service is easy to cross. A very considerable degree of subsidisation has been accepted in the water industry in the more sparsely populated areas, although this industry began as a fully self-supporting enterprise in the towns. Although subsidisation is not an immediate, or even a distant prospect, in the gas and electricity supply industries,

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(1) Cf. pp.431-2.

in other nationalised industries, notably transport, it is already present. Some consideration may therefore be given to the motives behind such subsidisation, or the reasons justifying the making of a loss by a Public Corporation or other form of public ownership, as a matter of deliberate policy. There has been a tendency for loss making by a nationalised industry to be condemned whatever the circumstances by those on one side of the political watershed of our times, while those on the other sometimes dismiss the whole business of achieving a surplus or a loss as altogether irrelevant.(1)

There are five possible arguments which may be used to justify the making of a 'planned' loss by a nationalised undertaking. The first two need only be mentioned briefly, since they did not apply to municipal 'trading' and therefore did not arise directly in this study. A newly established industry may take some time to achieve a surplus-earning position, and so it is reasonable to allow some subsidisation until the industry has become established. Even a newly-formed company may be prepared to lose money at first. The statutory provision for diminishing losses

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(1) See, for example, debate on Finance Bill, 2nd Reading, House of Commons, 18th May, 1949.

in the early years of air transport is an example of this type of planned loss. Secondly, there is the 'autarchy' argument, that some industries, such as rail transport, must be kept operating, even if this demands persistent subsidisation, because they are essential in time of war. The last three arguments can also be seen in the development of subsidisation by local authorities. The meeting of part or all the cost of a service from taxation may be justified as the most effective way of collecting payment. It would be difficult to apportion the cost of public lighting or a sewage scheme equitably amongst all those who benefitted from it, so it is much easier and more efficient to finance it out of taxation funds. Payment through taxation also makes possible the introduction of the 'insurance principle' into meeting the cost of supplying those services which are only needed occasionally. Most people would prefer to support the police force out of a very small addition to the burden of taxation paid by them, rather than to face the possibility of very heavy charges when their house happened to be burgled or they needed any other special police assistance. There is an intermediate state between supporting an industry from taxation and from charges made to individual consumers based on cost, which is exemplified in the usual method of charging for water supplies. That is to base the

charge not on the amount of consumption but on some other consideration, such as the size of the house supplied, which does not necessarily bear any relationship to the cost of supply. The same principle has now been introduced into the determination of the standing charge in electricity tariffs.

The supply of a particular service may be subsidised as a means of redistributing income. As we have already seen, the result of the different financial policy of municipal gas and electricity undertakings, as compared with those owned by companies, was a redistribution of income in favour of the consumers of those services. If a service or commodity is supplied at a price lower than average total cost, and the difference met from taxation levied on a progressive basis, then the net result is an income transference from the upper income groups to the consumers of the commodity concerned. It may be doubted whether this motive alone will be very important in future. It is an inefficient way of redistributing income since the consumers of a particular commodity must comprise an indeterminate and changing group of people. There is already plenty of scope for income redistribution through progressive taxation and transfer payments without extending the subsidisation of particular services or commodities.

The last motive for making an overall loss in a publicly

owned industry is what may be called the 'guidance' of consumption. Public authorities in fact assume that in some respects consumers cannot be allowed a free choice as to the way in which they will spend their incomes. This motive is often confused with income redistribution since the approach taken by public bodies is not that they know better than consumers how they ought to spend their incomes, but that there are certain essential goods and services, like milk for school children, of which no one must be deprived on account of inability to pay. But it is evident that this form of subsidisation would continue even if an optimum distribution of income were to be achieved. Many parents would not freely allocate to their children a sufficient sum to buy them an adequate midday meal, even if their incomes were large enough, so that school meals are provided by local authorities and are subsidised. If a charge equal to the cost of the service was made to all those borrowing books from a public library, instead of providing the service 'free' and raising the necessary money by compulsory rates, tnen it is clear that some ratepayers would not use the extra income left to them from the lower rate charges to pay for borrowing books but would choose some alternative form of consumption. They are not compelled to borrow books, but they are guided in that direction by

the method of financing the service. (The provision by a public undertaking of supplies at less than cost price is of course akin to the subsidisation of private industry in the supply of some commodities such as foodstuffs). This 'consumption guidance' principle has been an important force in transferring some services from a 'trading' to a 'social' nature. It is not, however, likely by itself to be used to justify an overall loss in any of the industries now operated by state as distinct from municipal enterprise. It is probable, though, that it may be important in causing the second type of subsidisation which must be discussed here, - that of special classes of consumers.

Even while they are able to show an overall surplus, publicly owned industries may be able to carry out a considerable amount of cross-subsidisation of selected consumers. This is already a common practice where charges have been made subject to 'postalisation'. Those who live in country districts are subsidised in receiving postal services, water supplies (where deficits are met from the Exchequer as well as from the local rate fund) and in some cases with their transport facilities. In some cases postalisation may be the result of the inconvenience of any other method of collecting payment, rather than of any 'social policy', and in this form can occur under private as well as public

ownership.

It is not necessarily inconsistent with the profit motive to supply individual consumers at a price less than cost since the cost of distinguishing these consumers might be greater than the loss incurred by supplying them on a standard tariff. Under public enterprise the situation is changed. Cross-subsidisation may still exist merely as an accidental result of the convenience of standardising charges but it may also be the result of deliberate policy. A public authority may use the word 'ought' in considering its policy; - it may use other criteria than the cost of supply in deciding that some classes of consumers ought to be favoured or encouraged, and others penalised.

An example from municipal enterprise is the provision of free or cheap travelling facilities on buses to old age pensioners. The adoption of similar tariffs over wide areas for gas and electricity supplies implies a subsidisation of those who live at a distance from the coalfields at the expense of those who live near to them.(1) It is possible to envisage bigger future developments of this kind of cross-subsidisation. It might, for example, be decided to sell gas or electricity supplies at specially favourable rates

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(1) The British Electricity Authorities Bulk Supply tariff is discussed in the light of these remarks in Appendix A.

to some classes of industrial consumers (e.g. in a Development Area, or to the 'small man') as a matter of social policy.

The growth of the public ownership of industrial enterprise is undoubtedly one of the basic factors in the economic and political history of our times. The issues connected with the desirability of public ownership itself and those which arise when industry is put under public ownership, have created a whole new body of problems, both in the spheres of economics and of government. This study has touched upon those limited aspects of these problems which are common to different forms of public ownership. In bringing this study to an end the main points of the conclusions may be underlined.

Although no direct comparison has been made between municipal and other forms of public enterprise, a study of municipal enterprise must raise the question of whether, in recent years, the pendulum may not have swung too far in the direction of the Public Corporation type of public ownership. Whilst the fatal defects of the restricted areas of local authorities for generating electricity, and to a much lesser extent, in manufacturing gas, were made clear, on the other hand it seems that there may have been some advantages of municipal ownership which the Public Corporation does not

possess. The most important was flexibility to meet different local conditions and in the whole matter of relations with the consumer.

Much of the controversy about 'private enterprise versus public ownership' today centres around the issue of 'efficiency'. The attempt made here to compare the performance of local authorities and companies in the gas and electricity industries has shown what an indeterminate and even misleading concept, this may be. It was, in fact, impossible to find any great difference between the average company and the average municipal performance in relation to operating efficiency, though what advantage there was lay with the companies. It is apparent that concentration on this issue of operating efficiency, important though it may be, has diverted attention from other significant differences between public and private enterprise. In particular the possible effects of the different purposes of the two forms of ownership need to be considered more fully and deliberately.

It is not enough to assume, as some writers have done, that public enterprise ought always to keep the same rules as private ownership. There are, of course, not a few dangers involved when the restricted, but relatively clear cut

motive of private profit is replaced by the uncertainties of 'social purpose'. But public enterprise is entitled to develop a policy of its own which is likely to differ more and more from that of successful company operation. Few public undertakings are likely to decide that they ought to behave like the shareholders and directors of a joint stock company in seeking a reward for their entrepreneurial functions. Similarly, the board of a public undertaking may not always accept the rule that consumers are the best judges of their own interests, and that if they can find a satisfactory method of basing price on cost, then economic welfare will be automatically maximised. If they do not make this assumption then they surrender their power to shape policy in any very important matters according to any further 'welfare' considerations, and like municipal gas and electricity undertakings, will only differ from companies in their dealings with consumers through their borrowing powers and the elimination of divisible profit. If this premise about the relationship of cost, price, and welfare is accepted then the problems of pricing are purely technical ones such as those which have been discussed, for example in the marginal cost controversy.

Alternatively a publicly owned industrial enterprise

may reject the notion that prices based on cost are likely to produce the maximum degree of economic welfare. Although the Public Corporations may be given the statutory duty to raise sufficient revenue to meet all their costs, this does not rule out the possibilities of the development of this second approach. In some cases the statutory provision may in fact be ignored if it is politically expedient, without any retribution falling upon the Corporation concerned. It is not immediately likely that the railway system in this country will be reduced to those routes which are entirely financially self-supporting. Furthermore, a great deal of deliberate cross-subsidisation is possible, without incurring an overall loss. It seems clear that public enterprises will not be bound in their actions by the limitation of basing prices on costs at all times and in all circumstances. This being so, it is of great importance that they should become more aware of their own motives in departing from this cost pricing principle.

It is here, particularly, that positive guidance, as well as warnings about the dangers involved are needed. There may be some cases when it is desirable for the pricing policy of a public enterprise to be used as a means of redistributing income. Money costs of production may not always represent full 'social' costs or be an infallible

guide towards the best use of scarce resources. The free choice of consumers need not invariably result in the greatest amount of welfare for themselves and the community. If it is accepted that public enterprises can have a social purpose different from that of privately owned industry, then they may be encouraged to work out the implication of this in a less haphazard manner than at present. The problem of public ownership is not only that of operating efficiency; of trying to do exactly the same thing as private enterprise; there are also many fresh dangers and possibilities inherent in the obligation of public enterprise to take as its objective the economic welfare of the whole community.

THE END.

APPENDIX A.

THE BULK SUPPLY TARIFF OF THE BRITISH ELECTRICITY AUTHORITY.

The great mass of the voluminous discussion of the problem of charging for supplies of electric current has centred around the examination of retail tariffs. (Recent examples are the articles appearing in the 'Economist' on June 14 and June 21, 1952, entitled "The Price of Electricity", and Mr.H.S.Houthakker's article in the March 1951 'Economic Journal' - "Electricity Tariffs in Theory and Practice.") The purpose of this Appendix is to consider the Bulk Supply Tariffs on which the British Electricity Authority bases the charges made for current supplied to the Area Boards. These charges, as the principal item in the costs of the Area Boards, must obviously have a great effect on the level of prices which the Area Boards charge to consumers.

In making this examination of the B.E.A. Bulk Supply Tariff it is assumed that one objective of the tariff must be to cover all the costs (excluding interest payments) of the B.E.A. in providing the current. (The statutory duty laid on the B.E.A. by Section 36 of the Electricity Act is that it should "secure that the combined revenues of the Central Authority and all the Area Boards taken together are not less than sufficient to meet their combined outgoings

properly chargeable to revenue account taking one year with another"). This assumption leaves one basic problem to be solved. This is the decision as to whether or not any differences in the cost of supplying current to different Area Boards should be allowed for in the Bulk Supply Tariff. The B.E.A. could adopt the principle, sometimes called 'postalisation', by which the total cost of supply is averaged out over the whole country, and the same price charged everywhere, regardless of the actual cost in different areas. This practice is followed by the Area Boards themselves in their tariffs, which, in effect, overcharge consumers living in some districts (mainly in the urban areas with a high ratio of consumers per mile of mains) and subsidise those living in others. Alternatively the B.E.A. could attempt to base the tariff for each Area Board on the actual cost of supplying current to that particular Board.

There are three main factors (excluding variations in transmission costs) which might make the cost of supplying current to one Area Board different from that of supplying another. These are -

1. The costs of transporting fuel to the power stations situated in the different Generating Divisions of the B.E.A.

(which correspond to the areas of the Area Boards) vary. These costs will depend mainly upon the distance from suitable coal supplies, and on the method by which coal can be transported.

2. The average thermal efficiency of the power stations from which the different Area Boards are supplied may vary.

3. Some Area Boards may have more favourable Load Factors than others, thus reducing the average cost to the B.E.A. of the current supplied to them.

The B.E.A. Bulk Supply Tariff takes some account of factors 1 and 3 in varying the price charged to different Area Boards, but none of variations in the efficiency of power stations. The allowance made for differences in the Load Factors may be considered first, as this is, perhaps, the least controversial and most straightforward part of the tariff. There can be little doubt that the tariff should provide some positive encouragement to Area Boards to improve their Load Factor. The Bulk Supply Tariff provides for the supply of current at a cheaper rate to those Area Boards which have more favourable Load Factors through the method by which the fixed kilowatt charge, which forms one part of the tariff, is calculated. This kilowatt charge is based upon the 'simultaneous maximum demand' of

the Area Boards for current. This 'simultaneous maximum demand' is defined as -

"twice the largest number of kilowatt-hours supplied by the Central Authority to the Area Board during any half-hour between 7.0 a.m. and 7.0 p.m. on any Monday, Tuesday, Wednesday, Thursday or Friday, or between 7.0 a.m. and 12 noon on any Saturday in the year of account, and one-third of the number of kilowatt-hours (if any) by which twice the largest number of kilowatt-hours supplied by the Central Authority to the Area Board during any half-hour as aforesaid, is exceeded by twice the largest number of kilowatt-hours so supplied during any other half-hour during the year of account."

The best way to test this formula seems to be to compare the actual variations in the fixed charges to different Area Boards which result from its operation with variations in the Load Factors of the Boards. The following table is based on figures given in the Fourth Report, 1951-52, of the B.E.A. (p.50 and 156-7) and shows the Load Factor and the fixed charge per million units supplied for five Area Boards.

Load factors and fixed charges of five Area Boards.

Board.	Fixed charge per million units sold supplied by Central Authority	Load Factor
	£	
London	1116.6	42
South Western	1019.5	46
North Western	984.82	48
Midlands	981.8	48
South Wales	746.38	63

The next table shows a comparison of the position of the other Area Boards with that of London. The percentage differences in the Load Factor and in the fixed charges are both measured as percentages of the higher figures.

Percentage differences in Load Factor and fixed charges of London and other Area Boards.

Board.	Load factor advantage compared with London.	Amount by which fixed charge per million units supplied was lower than for London.
	%	%
South Western	9.1	8.6955
North Western	12.5	11.801
Midlands	12.5	12.071
South Wales	33.3	33.154

This table shows that in the cases investigated there is a close relationship between variations in Load Factor and in the amount of the fixed charge made in the B.E.A. Bulk Supply Tariff.

The second part of the B.E.A. tariff consists of a running charge of .33d per kilowatt hour supplied. This running charge is varied for each Area Board according to the average cost of fuel in its area. A variation of .0007d for each penny by which fuel costs per ton above or below 38/- is made in the running charge. This part of the Bulk Supply Tariff gives rise to the obvious question why should the charge to different Area Boards be made to vary according to regional differences in fuel costs but take no account of actual cost of generation in each Generating Division? In the book "Electricity Supply in Great Britain" by Sir Henry Self, the Vice-Chairman of the B.E.A., and Elizabeth Watson, it is stated that - "Apart from fuel costs and, to a lesser degree, some other costs, it is hardly possible - even were it expedient - to distinguish variations in the overall economy of interconnected generating and transmission systems, in one part of the country as compared with another." (p.179). It is argued that the tariff should not be related to generating costs because the current supplied to a particular Area Board may not necessarily come from power stations situated within its area, and because "the location and numbers of points of supply in each area are largely an inheritance from pre-vesting

days." (p.180 op.cit.). The argument concludes "Thus even if it were practicable on other grounds to adopt a tariff which purported to reflect the costs of generation and transmission incurred by a particular Board, such a tariff would be bound to give rise to many anomalies." (p.180, op.cit.). The results of this policy are shown in the following table which compares the average works cost of generation in the different Divisions with the running charge per unit made to the corresponding Area Board. The figures are taken from pages 51 and 99 of the 1951-2 B.E.A. Report.

Works cost of B.E.A. Generating Divisions and Running Charges made to Area Boards in England and Wales, 1951-2.

Area Board or Division.	Effective unit charges in Bulk Supply Tariff.	Works cost per unit.
	d.	d.
South Wales	.4077	.4290
East Midlands	.4511	.4651
Yorkshire	.4539	.4497
North Eastern	.4574	.4640
North Western	.5008	.5309
Midlands	.5085	.4844
Mersey & N.Wales	.5267	.5559
South Western	.5442	.6275
Eastern	.5799	.5733
London	.5813	.6147
Southern	.5883	.5970
South Eastern	.5897	.5754

The arguments for varying the Bulk Tariff running charge according to fuel costs rather than according to works costs of generation cannot be said to be very convincing. If the operation of the Grid system does in fact make it impossible to identify the sources of supply of an individual Area Board then it seems to follow that a price variation based on the cost of fuel inside that Area is illogical. If the current used in the Area was not generated in that district then the cost of fuel in the Area is hardly more relevant as a factor in the tariff than would be the price of cabbages. If it is anomalous to consider the historical accident of the siting of the more efficient power stations, is it not equally anomalous to make allowance for the geographical accident of the location of the coalfields?

The only purpose of a differential tariff must be to relate prices to actual cost of supply and to encourage consumption in those Areas where the cost is lowest. From the point of view of the national economy it is desirable that the average cost of generating current should be as low as possible. In terms of real resources this means economy in the use of machinery (affected by the load factor), labour, fuel, and transport facilities. If there is a sufficiently close relationship between the area of an

Area Board and the sources of its supply of current to make it relevant to vary the tariff with fuel costs then it would seem to be more appropriate to consider works cost of generation. This would allow for differences in labour costs and efficiency in using fuel, as well as for differences in the cost of transporting fuel. It might be in the national interest to transport coal a greater distance to a power station with a higher thermal efficiency rather than consume it in a station situated on the coalfield but with a lower thermal efficiency. The present tariff allows for differences in transport costs but ignores thermal efficiency altogether. The effect of this is to penalise Area Boards with relatively high fuel transport costs and stations of a high level of thermal efficiency, and to favour Areas where fuel transport costs are low, even though the stations situated in their area are of a relatively low thermal efficiency. Thus in the above table the Midlands Area Board had to pay .0241d per unit more for its running charge than the average works cost of generation in the corresponding E.E.A. generating division, whereas the South Western Board (presumably because of the low cost of transporting coal from South Wales by sea) paid .0833d per unit less than the works cost of generation.

In conclusion, it seems that the present B.E.A. Bulk

Supply Tariff falls between the two stools of complete 'postalisation' and relating price to the actual cost of supply for each Area Board. If differences in cost are to be considered, then this could be done more satisfactorily by basing the variation in the tariff on the average works cost of generation in each Division, rather than on fuel transport costs alone.

APPENDIX B.

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PUBLIC AND PRIVATE FINANCING OF INDUSTRIAL ENTERPRISE

THE purpose of this article is to compare the positions of public and private enterprise in relation to the cost of raising capital, and to consider the significance of the generally accepted fact [1] that a public undertaking can finance its operations more cheaply than can private industry. After the introduction a comparison of the actual " total capital charges " of public and private undertakings in the pre-nationalised electricity industry is made, and the article is concluded by a more general discussion of the significance of the different positions of public and private enterprise in financing their activities. The term " total capital charges " is used here to include both interest payments and the payment of dividends, or their equivalent. For companies " total capital charges " includes the interest on loan capital, and the dividends paid on all forms of share capital; for public authorities it covers loan charges and any transfers of surplus " outside " the undertaking in which it arises—*e.g.*, from a nationalised industry to the Treasury or from a municipal undertaking to the General Rate Fund.

There are two reasons why a public undertaking might be expected to finance its operation more cheaply than private enterprise. First, it can guarantee interest payments from public funds and, because of the greater degree of security resulting, borrow money at a lower rate of interest than most companies. Secondly, any profit or surplus need not be distributed to shareholders, but can be retained within the undertaking. On the other hand, public enterprises must pay fixed interest charges in both good and bad years, whereas companies can reduce or suspend dividend payments. As is shown in the following investigation of electricity undertakings, a straightforward comparison of " total capital charges " in relation to the capital outstanding does not " tell the whole story " about the relative positions of company and public undertakings. This is because the capital outstanding

[1] Under the 1926 Electricity Supply Act, for example, local-authority electricity undertakings were allowed to transfer surpluses amounting to not more than 1½% of outstanding loans in aid of rates. This was supposed to be equivalent to the advantage of local authorities in raising new capital.

does not always vary directly with the actual physical size of the enterprise. Some undertakings, both public and private, may have been developed by ploughing back profit, or surplus, rather than by raising fresh capital. Some public enterprises, particularly those owned by local authorities, have repaid a considerable proportion of the loans which they have raised. Both these factors would mean that the capital outstanding did not represent the size of the undertaking, and that to measure "total capital charges" solely in relation to capital would be misleading.

For a practical examination of the "total capital charges" of public and private enterprise the electricity industry before nationalisation has been chosen for the following two reasons. First, both public and private ownership existed at the same time so that there is no difficulty about comparing different periods of time. Secondly, the statistics published by the Electricity Commissioners (and latterly by the Ministry of Fuel and Power) make a comparison of a large sample of undertakings relatively easy. There are certain difficulties in relation to the ownership of generating-stations, mentioned below, but these can be eliminated for a reasonable number of undertakings. Other practical difficulties of comparison are probably no greater than they would be for any other industry.

The first basis of comparison is that of "total capital charges" in relation to the amount of capital outstanding. A difficulty arises here in that for the municipal undertakings the only figure of outstanding capital is that for "Net Debt" which is the balance of outstanding loans, minus the balance of any Sinking Funds. Since separate figures of the amount of Sinking Funds are not available, it is not possible to give exact figures of the amount of the loans on which interest is paid. This means that some of the figures of capital may be smaller than the amount on which interest is paid, and therefore the interest rates shown for municipal undertakings may in some cases be higher than the true figure.

The table on page 806 shows a comparison between thirteen pairs of company and municipal electricity undertakings of similar size (judged by the amount of capital outstanding).

With each of these pairs of electricity undertakings of similar size the municipal undertaking had lower "total capital charges," the largest difference being 6·2 and the smallest 0·5. The difference between the average rate for all the municipal undertakings in the sample and that for the companies was 3·21.

Total Capital Charges of a Sample of Company and Municipal Electricity Undertakings, 1947–48 [1] [a]

Undertaking. [b]	Capital. [c]	Loan charges.	Rate contribution or dividend.	Total charges.	Rate of interest.
	£	£	£	£	%
Blandford Co.	16,000	—	1,280	1,280	8·0
Caernarvon	16,438	596	—	596	3·6
Ilfracombe Co.	50,000	—	3,000	3,000	6·0
Dartford	48,596	511	278	789	1·6
Paignton Co.	100,000	—	4,000	4,000	4·0
Aberystwyth	100,872	3,404	—	3,404	3·4
Central Sussex Co.	260,000	845	13,000	13,845	5·3
Burnley	269,352	12,847	—	12,847	4·8
Richmond Co.	310,000	—	18,600	18,600	6·0
Brentford	300,092	9,053	—	9,053	3·0
Isle of Wight Co.	450,000	—	34,500	34,500	7·7
Battersea	461,966	18,725	—	18,725	4·05
Cambridge Co.	530,000	2,213	35,000	37,213	7·0
Hastings	507,405	13,372	—	13,372	2·6
West Kent Co.	1,000,000	—	72,500	72,500	7·25
Plymouth	1,039,936	36,876	—	36,876	3·5
London Electricity Supply Co.	1,573,325	1,631	94,399	96,030	6·1
Coventry	1,697,368	60,951	—	60,951	3·6
Electricity Distribution of Yorkshire Co.	3,302,573	18,460	213,732	232,192	7·0
Portsmouth	3,304,386	95,158	—	95,158	2·9
Derby and Notts Electric Power Co.	4,850,000	77,955	337,500	415,455	8·6
Preston	4,990,658	121,887	—	121,887	2·4
Lancashire Co.	7,267,495	142,036	318,784	460,820	6·3
Bristol	7,136,175	244,826	—	244,826	3·4
London Power Co.	14,423,582	670,989	3,000	673,989	4·7
Birmingham	13,806,159	475,736	—	475,736	3·4
Average :					
Companies					6·46
Local Authorities					3·25

[1] Compiled from Ministry of Fuel and Power, *Return of Engineering and Financial Statistics relating to Authorised undertakings in G.B., 1947–8.*

[a] Year ending December 31, 1947, for companies, March 31, 1948, for local authorities.

[b] Municipal undertakings in italics.

[c] Net Debt for municipal undertakings, total of loan and share capital for companies.

The following table shows the same relationship between " total capital charges " and " capital " for two random samples of thirty-three company and of thirty-three municipal electricity undertakings.

" Total Capital Charges " of Random Samples of Municipal and Company Electricity Undertakings, 1947–48 [1]

Sample.	Loan charges.	Rate Fund contribution or dividend.	" Total capital charges."	Capital.	Rate % of capital charges.
	£	£	£	£	%
33 company undertakings . .	72,821	653,182	726,003	11,456,687	6·3
33 municipal undertakings .	329,563	24,673	354,236	10,405,589	3·4

This table supports the evidence of the previous one, showing that there was a difference of 2·9 between the average rate per cent of " capital charges " for the municipal and company undertakings.

These figures show only the relation of total interest payments to outstanding capital, and, as explained above, do not necessarily reflect the relationship between the size of the undertaking as measured by its sales of energy and " total capital charges." It is therefore useful to make a comparison between the total capital charges and the electricity sold by company and municipal undertakings. Since electricity undertakings owning generating-stations would need to raise more capital, in relation to sales of current, than undertakings engaged solely in distribution, the following comparison is confined to undertakings which did not own generating-stations in 1938–39. The relationship of " total capital charges " to units sold is not, by itself, a completely satisfactory way of measuring the relative cost of borrowing capital by municipal and company undertakings. This is because the capital cost of the distribution system will not always vary directly with the size of sales. Some undertakings will have higher sales per consumer, or a more favourable ratio of consumers per mile of mains, and consequent lower capital cost in relation to the units sold. This makes individual comparisons possibly misleading, but in the following comparison between random samples of ten companies and ten municipal undertakings there is no reason to

[1] Ministry of Fuel and Power, *Return of Engineering and Financial Statistics, 1947–8.*

suppose that either the companies or the municipalities are more favourably placed as a group. Figures for 1938–39 as well as for 1947–48 are given for two reasons. First, to provide a check on whether either group has increased its sales more proportionately than the other—a factor which would tend to give it lower capital charges per unit sold, since these costs are likely to increase more slowly than sales once the main distribution system is completed. Secondly, the year 1947–48, as the last year of independent operation before nationalisation, was to some extent abnormal, since some undertakings appear to have departed from normal practice in keeping prices artificially low, or in paying unusual sums in aid of rates in this period.

Comparison of Sales and "Total Capital Charges" of Municipal and Company Electricity Undertakings, not being Owners of Generating-stations, and having Sales exceeding 30,000,000 *units in* 1947–48.[1]

	Units sold (thousands).		Loan charges. £	
	1947.	1938.	1947.	1938.
10 companies . . .	1,866,135	1,135,235	148,567	112,916
10 municipal undertakings	831,164	501,461	101,303	147,038
	Rate-aid or dividends. £		"Total capital charges." £	
	1947.	1938.	1947.	1938.
10 companies . . .	985,250	1,017,465	1,133,817	1,130,381
10 municipal undertakings	54,009	35,291	155,312	182,329

This table shows that both municipal and company undertakings were able to expand their sales considerably between 1938 and 1947 without any corresponding increase in "total capital charges." The percentage increase of sales for the sample of company undertakings was 64·4, while "total capital charges" increased by only 0·3%. The municipal undertakings increased their sales by 39·7%, while their "total capital charges" decreased by 14·8 on the 1938–39 figure. The municipal undertakings paid more in aid of rates in 1947–48 than in 1938–39, but reduced the loan charges very considerably. The following shows the "total capital charges" per thousand units sold for the same sample of municipal and company undertakings.

[1] Compiled from Electricity Commissioners and Ministry of Fuel and Power Returns, 1938/9–1942/3 and 1947/8.

"Total Capital Charges" per Thousand Units of Energy Sold for Samples of Municipal and Company Electricity Undertakings, 1938–39 *and* 1947–48.[1]

	"Total capital charges" per thousand units sold.	
	1938–39.	1947–48.
10 companies	19*s.* 10·97*d.*	12*s.* 1·82*d.*
10 local authorities . . .	7*s.* 3·26*d.*	3*s.* 8·85*d.*

Thus the advantage of the municipal undertakings in respect to "total capital charges" is greater when this is measured in relation to the total units sold than in relation to the total capital raised.

One of the implications of the power of public authorities to borrow capital at a low rate because of the security of public funds, is that the theoretical function of the rate of interest as a means of allocating new investment according to the expectations of the market, disappears. As the risk involved in all forms of public investment is made the same artificially, it will no longer be reflected by the interest rate. This could result in an over-expansion of one particular public enterprise, or of all public enterprise, at the expense of private industry, compared with what would occur if the ordinary forces of the market were not disturbed. In an economy where the main decisions on investment are made by a planning authority of some kind, and not left to the decision of the market, there seems to be little point in this criticism of one aspect of public borrowing. One may, or may not, wish to challenge the basic contention that a central planning authority can make investment decisions which will benefit the "public interest" more than would those made in a free market. But within an economy where, for better or worse, the main course of investment is planned, there would seem to be little purpose in sighing for "free" interest rates in public enterprise.

The fact that public enterprise can finance its operation more cheaply than private industry is not necessarily an advantage. The lower interest rate does not reflect any direct superior physical efficiency. It may result in a lower price being charged for the commodity being produced, but this does not mean that there is any real economy in the use of goods and services. The main results of lower interest rates paid by public bodies, and of the elimination of a divisible profit, will be a distribution of income different from that which would result from private ownership. There are four groups of people whose incomes might be affected

[1] Compiled from Electricity Commissioners and Ministry of Fuel and Power Returns, 1938/9–1942/3 and 1947/8.

where an industry is financed by " public " methods. These are the workers, the consumers, tax-payers (including rate-payers) and bond and shareholders. In order to simplify the situation two assumptions are made. First, workers are excluded from the discussion, since, under present conditions, it is very unlikely that their wages would be affected by the lower " total capital charges " attributable to public ownership. In industries which have been partly publicly and partly privately owned the same wage-rates have generally applied in both sectors. It is quite clear to-day that there is little remaining possibility of increasing wages at the expense of shareholders. Secondly, it is assumed that the class of people who provide the capital for a public enterprise are the same as those who would finance a private undertaking. For the sake of brevity, these people, whether they owned Debenture, Preference or Ordinary shares in a company, or the bonds of a loan raised by a public authority, are called here " lenders."

These assumptions having been made, the effects of " public " financing can be illustrated from the electricity industry. Where there was no transfer to or from the rate fund, the result of lower " capital charges " in the publicly owned sector of the electricity industry would be equivalent to a redistribution of income in favour of consumers of electricity and at the expense of " lenders." If part of the surplus was transferred to the rate fund, then both the rate-payers and (or) the electricity consumers gained, again at the expense of the " lenders." Where there was a deficit which was made up from the rate fund, then the " lenders " gained at the expense of rate-payers, while the position of consumers was no different from what it would have been in a company (in which the shareholders would have borne the loss by foregoing their dividends).

The result of public financing is, then, that risk-bearing is transferred to the tax-payer. If the tax-payer receives no reward for this in the form of transfers from surpluses to reduce rates or taxes, then he will, at best, gain nothing, and when deficits occur, he will lose.[1] The consumer will gain, through lower prices or improved services, so long as the tax-payer receives a smaller reward for risk-bearing than did the private investor. If it is assumed that there is a net financial reward for bearing the greater financial risk of private industry (*i.e.*, that the net yield over a long period covering both good and bad years is higher for owners of shares in private industry than for holders of public

[1] Cf. Lord Brand, " Private Enterprise and Socialism," ECONOMIC JOURNAL, September 1948, Vol. LVIII.

stock), then " lenders " lose financially, though they may gain in peace of mind. The position of " lenders " where an industry (as a whole or over a long period) makes a deficit can best be considered in the following discussion of the effects of " public " financing on the equality of income distribution.

The methods of financing public enterprise will not necessarily lead to a more equal distribution of income than would those adopted by private business. The effect will depend upon how the class of " lenders " is made up, who are the consumers of the commodity or service produced, whether any losses demanding subsidy from public funds are made and where the incidence of extra taxation necessary to make a subsidy falls. If it is assumed that the group of lenders is made up mainly from the higher income groups, that the commodity concerned is widely consumed and that extra taxation, whether central or local, will fall on the whole community roughly in proportion to income, then the following conclusions can be made. Where there is a net surplus, then public financing will tend to a more equal distribution of income, as consumers pay less while " lenders " receive less, and the level of taxation is not affected. (If there is a transfer to public funds the effect on distribution will depend on which taxes are reduced.) In the electricity industry in the years investigated there were few drawings on Rate Funds. (During the whole period 1938/9–1942/3 and 1947/8, eighteen municipal electricity undertakings required subsidies on thirty-three occasions. The number of undertakings existing in England and Wales at the beginning of the period was 335.) It may therefore be concluded that the lower income groups gained where public ownership meant lower " total capital charges " in this industry. Where there is a deficit for an industry, taken as a whole, and that deficit must be met from public funds, then, on the above assumptions, the distribution of income is made more uneven, since the incomes of " lenders " are maintained at the expense of tax-payers. Thus any state-subsidised losses in the railway industry would involve a distribution of income more favourable to the upper income groups than that which would have resulted if the same losses had been made under private ownership.

In conclusion, it may be stated that public ownership resulting in lower " total capital charges " is likely to benefit consumers, but, wherever there is a deficit, this will be at the expense of transferring income from tax-payers to the class of " lenders " of capital.

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AREAS OF MUNICIPAL & COMPANY GAS UNDERTAKINGS.

Authorised area of supply for statutory undertakings is indicated by thick black line. [—]

Small circles indicate non-statutory companies. [o].

Actual areas supplied by statutory undertakings are coloured:—

BLUE indicates company undertaking. [ ].

RED indicates municipal undertaking [ ].

Municipal undertakings selling more than 5,000,000 therms in 1947 are named, [e.g. LEEDS]. The figures beneath the names represent millions of therms sold (to nearest million) in 1947.

[Based on Map 'A' of 'The Gas Industry' 1945, & Return relating to Gas Undertakings, 1947].

DARLINGTON 7·0
STOCKTON 5·0
MIDDLESBROUGH 10·5
BLACKPOOL 9·5
BURNLEY 7·0
BLACKBURN 6·5
BRADFORD 13·0
LEEDS 22·0
SOUTHPORT 6·0
BOLTON 7·0
HUDDERSFIELD 8·0
WIGAN 10·0
ST HELENS 8·0
SALFORD 9·0
STRETFORD 10·0
MANCHESTER 35·0
SWINTON 5·0
ROTHERHAM 12·0
WARRINGTON 7·0
SALFORD 5·0
BIRKENHEAD 8·0
CHESTERFIELD 6·0
LINCOLN 6·0
STOKE 24·0
NOTTINGHAM 21·0
LEICESTER 16·0
WALSALL 5·0
BIRMINGHAM 95·0
SMETHWICK 6·0
COVENTRY 17·0

PURCHASE OF COKE-OVEN GAS BY GAS UNDERTAKINGS.

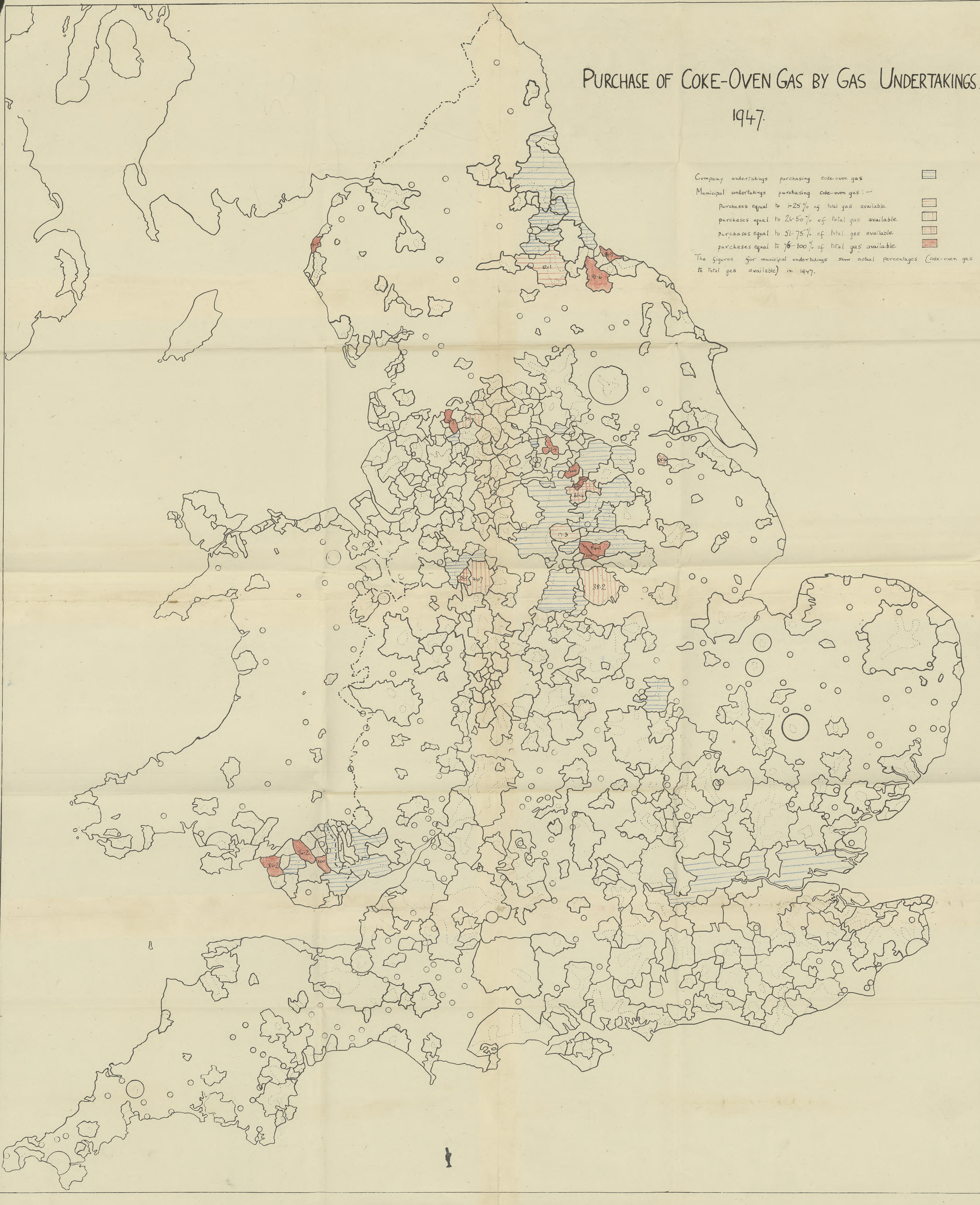
1947.

Company undertakings purchasing coke-oven gas

Municipal undertakings purchasing coke-oven gas :—

- Purchases equal to 1-25% of total gas available
- purchases equal to 26-50% of total gas available
- purchases equal to 51-75% of total gas available
- purchases equal to 76-100% of total gas available

The figures for municipal undertakings show actual percentages (coke-oven gas to total gas available) in 1947.



SALES OF MUNICIPAL GAS UNDERTAKINGS.

KEY.

Sales less than 500,001 therms.

Sales 500,001 – 1,250,000 therms.

Sales 1,250,001 – 5,000,000 therms.

Sales over 5,000,000 therms.

FIGURES RELATE TO YEAR 1944.

[Based on 'Return Relating to Gas Undertakings' 1944 & 'The Gas Industry' Map 'A'.]